

OLYMPIAD Prep-Guide

SCIENCE

- ▶ **Detailed Theory** with pictures, tables and flow charts
- ▶ **Olympiad Bite** containing unique facts
- ▶ **Self Test** to track the progress
- ▶ **Exercise** with different types of MCQs to practice
- ▶ **Achievers Section** to develop analytical/application skills
- ▶ **NSO Level 1 & Level 2** chapterwise previous year's questions
- ▶ **Covers Syllabus** of CBSE, ICSE, IB and State/Internationally Recognized Boards

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OLYMPIAD Prep-Guide

SCIENCE 5



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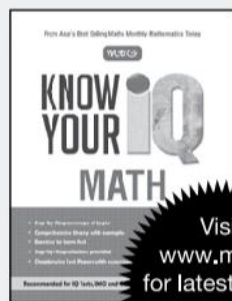
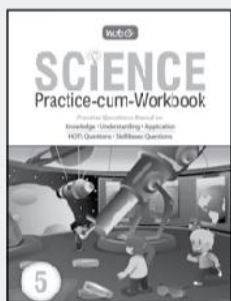
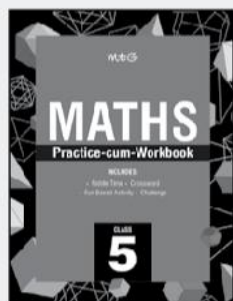
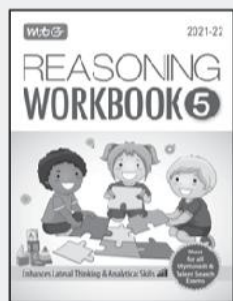
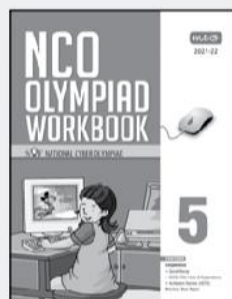
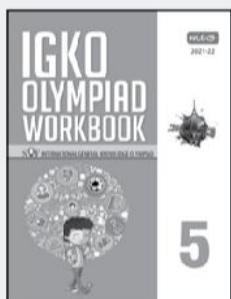
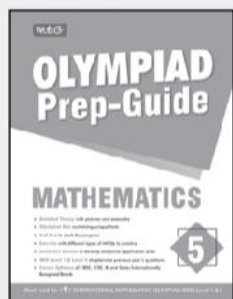
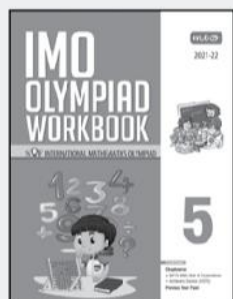
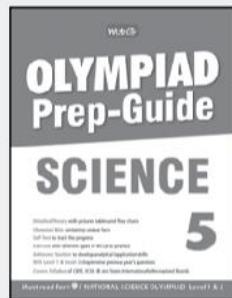
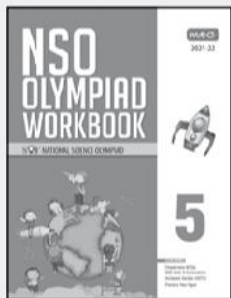
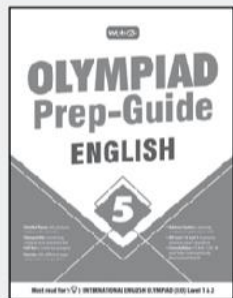
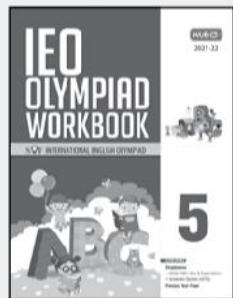
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 Regd. Office : 406, Taj Apt., Ring Road, Adjacent Safdarjung Hospital, New Delhi - 110 029.
 Web: mtg.in Email: info@mtg.in

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For CLASS 5 Olympiads must read...



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Olympiad Skill Development System

Previous Years Papers

Online Test

Preface

Olympiads serve in determining a child's true potential and competence which in turn can help her/him emerge strong in present-day competitive scenario. These exams persuade students to strive for broad understanding and strong grasp of scientific facts, strengthening their reasoning, analytical and problem-solving skills. They also help in bringing forth the areas in which a child lacks proficiency so that a proper orientation can be provided to improve the same. Olympiads not only develop interest of children studies but also inculcate the habit of applying the acquired knowledge.

These exams generally cover the basic syllabus of a particular class. Only the level of questions is slightly higher than the school level. The questions are based more on application than knowledge. So, for gaining good marks in such exams, students need to have clear concepts first.

Realizing the needs of students participating in National Science Olympiad (NSO), the official academic partner of Science Olympiad Foundation (SOF), MTG has come up with Olympiad Prep Guide Series for this Olympiad.

Salient Features of the Series :

Detailed Theory enriched with illustrative pictures, tables and flow charts to gain thorough knowledge of every topic.

Olympiad Bite keeps the students fully acquainted with latest as well as unique facts.

Self-test at regular intervals to help students track their progress and keep them motivated.

Exercise containing MCQs covering Knowledge based, Understanding based, Application based and Skill based questions of different levels enabling students to practice and build constructive thinking.

Achievers Section (HOTS questions) helps students to develop analytical and application skills.

Previous Year's Questions give a glimpse of the actual Olympiad question papers of NSO level 1 and 2.

Hints and Explanations with every chapter for quick guidance and better understanding.

Read, Lead and Succeed with MTG Olympiad Prep Guide as it is based on the latest pattern of SOF Olympiads. We wish you all the success in the Olympiad and a very bright future in the field of Science.

All The Best 
MTG Editorial Board

Wondering how to manage School and Olympiad study?

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Get

Study Plan | Preparation Tips | Strategy and Techniques | Experts Guidance

to attempt SOF Olympiads and achieve SUCCESS!

Syllabus & Exam Pattern

CLASS-1

Total Questions : 35

Time : 1 hr.

Logical Reasoning (Section – 1) : Spatial Understanding, Grouping, Measuring Units, Analogy, Geometrical Shapes, Patterns, Odd One Out, Ranking Test.

Science (Section – 2) : Living and Non-living things, Plants, Animals, Human Beings and Their Needs, Good Habits and Safety Rules, Air and Water, Weather and The Sky.

Achievers Section (Section – 3) : Higher Order Thinking Questions - Syllabus as per Section – 2.

Total Questions : 35

Time : 1 hr.

Logical Reasoning (Section – 1) : Patterns, Measuring Units, Odd One Out, Series Completion, Geometrical Shapes, Analogy, Ranking Test, Grouping of Figures, Coding-Decoding, Embedded Figures.

Science (Section – 2) : Plants, Animals, Human Body, Food, Housing and Clothing, Family and Festivals, Good Habits and Safety Rules, Transport and Communication, Air, Water and Rocks, Earth and Universe.

Achievers Section (Section – 3) : Higher Order Thinking Questions - Syllabus as per Section – 2.

CLASS-2

CLASS-3

Total Questions : 35

Time : 1 hr.

Logical Reasoning (Section – 1) : Patterns, Analogy and Classification, Coding-Decoding, Mirror Images, Embedded Figures, Alphabet Test, Ranking Test, Grouping of Figures, Figure Matrix, Geometrical Shapes, Days and Dates & Possible Combinations.

Science (Section – 2) : Plants and Animals, Birds, Food, Housing, Clothing and Occupation, Transport, Communication and Safety Rules, Human Body, Earth and Universe, Matter and Materials, Light, Sound and Force, Our Environment.

Achievers Section (Section – 3) : Higher Order Thinking Questions - Syllabus as per Section – 2.

Total Questions : 35

Time : 1 hr.

Logical Reasoning (Section – 1) : Patterns, Alphabet Test, Coding-Decoding, Mirror Images, Embedded Figures, Geometrical Shapes and Solids, Ranking Test, Direction Sense Test, Days and Dates & Possible Combinations, Analogy and Classification.

Science (Section – 2) : Plants, Animals, Food and Digestion, Human Needs, Matter and Materials, Force, Work and Energy, Our Environment, Earth and Universe.

Achievers Section (Section – 3) : Higher Order Thinking Questions - Syllabus as per Section – 2.

CLASS-4

CLASS-5

Total Questions : 50

Time : 1 hr.

Logical Reasoning (Section – 1) : Patterns, Analogy and Classification, Coding-Decoding, Geometrical Shapes, Mirror Images, Water Images, Embedded Figures, Direction Sense Test, Ranking Test, Alphabet Test and Logical Sequence of Words, Puzzle Test.

Science (Section – 2) : Animals, Human Body and Health, Plants, Natural Resources and Indian Heritage, Pollution and Calamities, Earth and Universe, Matter and Materials, Force and Energy.

Achievers Section (Section – 3) : Higher Order Thinking Questions - Syllabus as per Section – 2.

Total Questions : 50

Time : 1 hr.

Logical Reasoning (Section – 1) : Verbal and Non-Verbal Reasoning.

Science (Section – 2) : Motion and Measurement of Distances, Light, Shadows and Reflections, Electricity and Circuits, Fun with Magnets, Our Environment (Water, Air Around us, Garbage in Garbage out), Sorting and Separation of Materials, Changes Around Us, The World of Living (Characteristics of Living Beings, Parts of Plants, Body Movements in Animals and Adaptation), Food and its Components, Fibre to Fabric.

Achievers Section (Section – 3) : Higher Order Thinking Questions - Syllabus as per Section – 2.

CLASS-6

Total Questions : 50

Time : 1 hr.

CLASS-7

Logical Reasoning (Section – 1) : Verbal and Non-Verbal Reasoning.

Science (Section – 2) : Heat, Motion and Time, Electric Current and Its Effects, Winds, Storms and Cyclones, Light, Acids, Bases and Salts, Physical and Chemical Changes, Weather, Climate and Adaptations of Animals to Climate, Fibre to Fabric, Nutrition in Plants and Animals, Respiration in Organisms, Transportation in Plants and Animals, Reproduction in Plants, Natural Resources and Their Conservation (Soil, Water : A Precious Resource, Forests our Lifeline, Wastewater Story).

Achievers Section (Section – 3) : Higher Order Thinking Questions - Syllabus as per Section – 2.

Total Questions : 50

Time : 1 hr.

Logical Reasoning (Section – 1) : Verbal and Non-Verbal Reasoning.

Science (Section – 2) : Crop Production and Management, Microorganisms, Synthetic Fibres and Plastics, Metals and Non-metals, Coal and Petroleum, Combustion and Flame, Conservation of Plants and Animals, Cell, Reproduction and Endocrine System, Force and Pressure, Friction, Sound, Chemical Effects of Electric Current, Some Natural Phenomena, Light, Stars and the Solar System, Pollution of Air and Water.

Achievers Section (Section – 3) : Higher Order Thinking Questions - Syllabus as per Section – 2.

CLASS-8

NUMBER OF QUESTIONS AND MARKING SCHEME

Level - 1				
Class	Section	No. of Questions	Marks/question	Total Marks
1 to 4	Logical Reasoning	5	1	5
	Science	25	1	25
	Achievers Section	5	2	10
	Grand Total	35		40
5 to 8	Logical Reasoning	10	1	10
	Science	35	1	35
	Achievers Section	5	3	15
	Grand Total	50		60
Level - 2*				
3 & 4	Science	30	1	30
	Achievers Section	5	2	10
	Grand Total	35		40
5 to 8	Science	45	1	45
	Achievers Section	5	3	15
	Grand Total	50		60

* Level-2 exams will be held for students from class-3 onwards. For updated information keep visiting official website of Science Olympiad Foundation (www.sofworld.org).

HOW TO PARTICIPATE*

The SOF NSO is open to the students of classes upto 12. Prospectus containing the registration forms are sent to all schools registered with SOF. Schools not registered may also request for prospectus by sending an e-mail at info@sofworld.org or through a phone call. Registrations are accepted through schools only. Schools must return the registration forms to SOF, duly filled in and complete in all respects by the due date.

The SOF National Science Olympiad is conducted at two levels:

Level 1 : Level 1 is conducted for students of classes upto 12. First level of the test is organized in the respective schools of the participants during school hours.

👉 Level 1 competition is an objective-type test of 60 minutes duration comprising 35 multiple choice questions for class 1 to class 4 and 50 multiple choice questions for class 5 to class 12.

👉 The question paper consists of following sections:

For Class 1 to Class 10

Section-1: Logical Reasoning, Section-2 : Science and Section-3 : Achievers Section

For Class 11 and Class 12

Section-1 : Physics and Chemistry, Section-2 : Achievers Section and Section-3 : Mathematics/Biology

Level 2 : Level 2 is conducted free of cost for students of class 3 to class 12. Second level of the test is organized in the centres finalized by SOF.

Level 2 : The question paper consists of following sections:

For Class 3 to Class 10

Section-1 : Science and Section-2 : Achievers Section

For Class 11 and Class 12

Section-1 : Physics and Chemistry, Section-2 : Achievers Section and Section-3 : Mathematics/Biology

👉 There are separate question papers for each class/set.

👉 It is an OMR based test.

👉 The medium of the test is English.

👉 CBSE, ICSE/ISC, IB and State/Internationally Recognized Boards, etc. syllabi are followed for setting the test papers.

Students fulfilling either of the following 3 criteria will qualify for 2nd level Olympiad exams:

- Top 5% of students, class-wise who appear for the 1st level exam internationally.
- Top 25 rank holders from each State/Zone and each class.
- Class topper, where at least 10 students from a class appear in the exam and scores at least 50% marks. In case of section-wise registrations, class topper with highest marks from all sections will qualify for the 2nd level.

Clarifications : Any clarification regarding rules, format/pattern of the paper, etc., can be sought from SOF through e-mail at info@sofworld.org

* For more details, please visit www.sofworld.org

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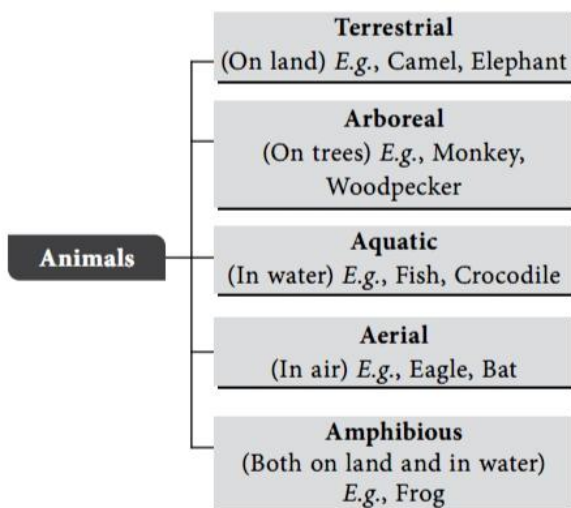
Learning objectives

- 1.1 Habitats of animals
- 1.3 Eating habits of animals
- 1.5 Movements in animals

- 1.2 Body coverings of animals
- 1.4 Breathing methods of animals
- 1.6 Adaptations in animals

1.1 HABITATS OF ANIMALS

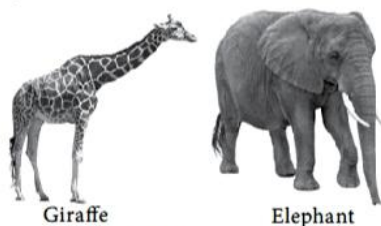
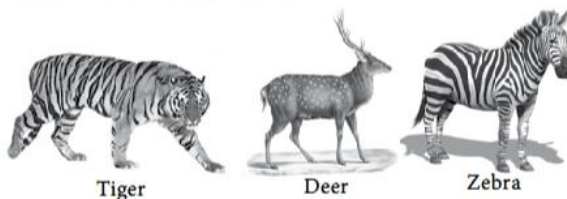
The world of animals is amazing. They are found almost everywhere, *i.e.*, on land, in air, on trees and in water. The place where an animal lives, grows and reproduces is called its **habitat**. Animals have different adapted features which help them to survive in their habitats. On the basis of habitat, animals are broadly classified as :

**Terrestrial Animals**

Animals living on land are called **terrestrial animals**. Land includes forests, deserts, polar regions, mountains, etc.

Forest is a vast area that is densely covered by trees and other plants. Forests provide shelter to animals like lion, tiger, deer, fox, elephant, monkey, etc. Animals live in caves and on/under trees in forests. Forests are also home to animals like hare, rat, snake, etc., which

live inside burrows. Small animals like earthworms, insects live on forest floors.

**Animals living in forest**

Deserts are sandy and dry areas that receive very little rainfall. They are usually hot during day time and cold at night. Animals like camel, rattle snake, etc., are found in deserts.



Mountainous regions are cold and often covered with snow. Animals like yak and mountain goat are found in mountainous regions.

The regions near North and South poles on Earth are called **polar regions**. The region around North pole is named **Arctic region** and the region around South pole is called **Antarctic region**. They are permanently covered with snow. Penguin, polar bear, arctic fox, arctic hare, etc., are some animals found in polar regions.



Polar bear



Penguin

Arboreal Animals

Animals like monkey, squirrel, koala, sloth, birds etc. live on trees. These are called **arboreal** animals.

Monkeys have strong limbs to help in climbing. Some have a long tail which can be coiled around the branches of trees.



Sloth



Monkey

Aquatic Animals

Animals that live in water are called **aquatic animals**. Aquatic habitats can either be freshwater habitats or salty water habitats.

Freshwater is naturally occurring water on the earth's surface. It contains minimal quantities of dissolved salts. Some examples of freshwater habitats are ponds, lakes, rivers, streams, etc. Animals living in freshwater include variety of fish, birds like duck and swan, crocodile, some insects like dragonfly etc.

The body of a fish is covered with a layer of flexible, overlapping scales. Fish have fins which help in swimming. Fish breathe through gills.

Salty water habitats include oceans and seas. An ocean is a vast and continuous body of saline (salty) water. It is the largest habitat on the earth. A large variety of animals are found here. Some of them are whale, dolphin, seal, seahorse and octopus. These animals are well-adapted to live in salty water.



Dolphin



Shark

Aerial Animals

Animals that stay mostly in air are called **aerial animals**, e.g., birds, bats, etc. Birds build nests on trees.

They have wings to fly with. Birds have hindlegs which are differently modified for walking, running, hopping or perching. They have hollow bones to reduce body weight as an adaptation to fly.



Toucan



Eagle



Swallow

Flying birds

Some birds, e.g., ostrich, kiwi, emu, etc., cannot fly. They are called **flightless birds**.



Emu



Kiwi



Ostrich

Flightless birds

Amphibious Animals

Animals that can live both on land and in water are called **amphibious animals** e.g., frog, toad, etc.



Frog

1.2 BODY COVERINGS OF ANIMALS

Different animals have different types of body covering. Body covering helps an animal to live and survive in a particular habitat. It also helps the animal to keep its body warm and protect itself from predators.

Types of Body Covering

Cuticle

Body of insects, i.e., butterfly, grasshopper, beetle, etc., is covered by hard covering called **cuticle**. It helps them to protect their soft body.



Butterfly



Beetle



Ant

Scales

Body of fish, reptiles, etc., is covered with scales. Scales are present on the legs of birds. Scales are hard and overlapping structures that do not let water enter the body of animal thereby protecting the skin present underneath it. Fish scales are derived from bone in the deeper layer of the skin known as **dermal layer**.

Reptilian and bird scales are derived from superficial layer of skin known as **epidermis**. These scales are not separate detachable structures like fish scales instead they are connected in a sheet.



Reptilian scales



Fish scales

Types of scale

Shell

Body of animals like snail, tortoise, armadillo, etc., is covered by hard covering commonly called as **shell**.



Snail



Tortoise

Types of shell



Olympiad Bite

Skin of crocodile, shell of tortoise and bony armour of armadillo are made up of scutes. Scutes are similar to scales and serve the same function. However, scutes are bony external plates formed from deeper layer of skin.

Feathers

Body of bird is covered with feathers which protect it from rain and cold. Feathers help to keep a bird's body warm. Flight feathers present in wings help the birds to fly. Feathers of some birds like peacock have beautiful patterns and are brightly coloured.



Parakeet

Feather

Spines

Bodies of some animals like spiny anteater, hedgehog and porcupine are covered with needle-like outgrowths called **spines**. They act as an armour to protect the animal from enemies.



Spines

Porcupine

SELF TEST - 1

1. Which of the following animals can be placed in box X?

Animals according to habitat



- (A)  (B) 
- (C)  (D) 

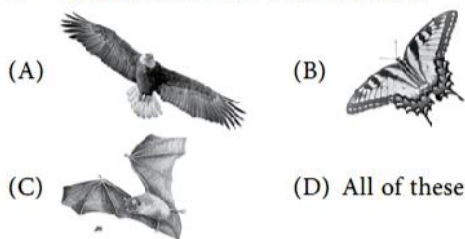
2. Frogs are _____ animals.

- (A) Herbivores
(B) Amphibious
(C) Arboreal
(D) Aquatic

3. What is common for a snail and a turtle?

- (A) Paddle-like limbs
(B) Shell
(C) Back bone
(D) All of these

4. Which of these is an aerial animal?



5. Body of animal 'X' is covered with



- (A) Feathers
(B) Fur
(C) Hair
(D) Cuticle.

1.3 EATING HABITS OF ANIMALS

All animals need food for growth and development. Different animals have different eating habits. Body parts of animals *i.e.*, teeth and mouth are adapted variously to suit their eating habits. According to the eating habits, animals are classified as herbivores, carnivores and omnivores.

Herbivores

Animals that eat only plants and plant products are called as **herbivores** *e.g.*, cow, sheep, goat, zebra, etc. They have sharp front teeth called **incisors** for cutting and large and flat back teeth called **premolars** and **molars** for grinding and chewing.



Teeth of herbivores

Carnivores

Animals that eat flesh of other animals are called **carnivores** *e.g.*, lion, tiger, etc. Carnivores have sharp and pointed teeth called **canines** that help them to tear the flesh. They have strong premolars and molars for chewing flesh.



Teeth of carnivores

Omnivores

Animals that eat both plants and animals are called **omnivores** *e.g.*, bear, humans, etc. They have sharp and flat incisors for biting and flat and broad premolars and molars for grinding and chewing.



Teeth of omnivores

Animals that feed on dead animals are called **scavengers** *e.g.*, vulture, hyena, etc. Some animals called **rodents** like rabbits, rats and squirrels (which are also mammals) gnaw their food. Their front teeth are sharp and strong. They are also herbivores.

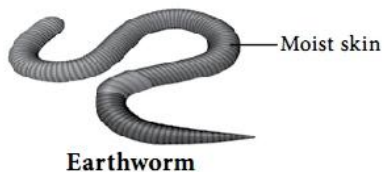
1.4 BREATHING METHODS OF ANIMALS

Animals breathe continuously to stay alive. During breathing, oxygen rich air is taken in and carbon dioxide rich air is given out. Oxygen burns the food within their bodies and releases energy for various activities. Animals get their oxygen supply from their surroundings.

Terrestrial animals take oxygen from air while aquatic animals take oxygen dissolved in water. According to their habitats, different animals have different organs for breathing.

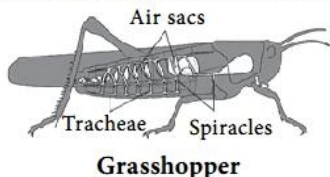
Through Skin

Earthworms breathe through their moist skin. Microscopic animals like *Amoeba*, *Paramecium* breathe through their body surfaces. Frogs breathe through lungs when on land and through their moist skin when in water.



Through Spiracles

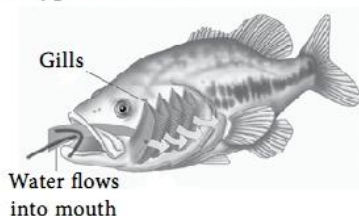
Insects like butterfly, grasshopper, dragonfly, cockroach etc., breathe through air holes on their body surface called **spiracles**. The air travels to each part of the insect's body through a network of tiny tubes called **tracheae**. Air enters through spiracles, passes through tracheae to reach tissues. In tissues, oxygen is taken in and carbon dioxide is given out which is removed through spiracles.



Through Gills

Aquatic animals, like fish, tadpole, prawn, etc., breathe through gills. Gills are feathery organs full of blood vessels. A fish keeps gulping water through the mouth and pushes it through gill passage. As water passes

through thin walls of gills, blood vessels in the gills take in the oxygen dissolved in water.



Through Lungs

Animals belonging to higher groups, i.e., reptiles, birds and mammals breathe through lungs which are paired, elastic bag-like structures. Below the lungs lie the diaphragm. Ribcage, lungs and diaphragm work together during breathing.

When air is taken in, it enters the body through the nostrils and passes through the wind pipe to reach the lungs. The lungs are richly-supplied with blood vessels. In lungs, exchange of gases occurs between the blood and the air. Oxygen is absorbed into the blood while carbon dioxide is given off. Carbon dioxide passes out the body through nostrils following the same path in reverse order.

Whales and dolphins are aquatic mammals that breathe through lungs. They get oxygen from air, for this they come to water surface to breathe. They breathe through **blow holes**.

SELF TEST - 2

- Rabbits, rats and squirrels belong to the group of
(A) Reptiles (B) Rodents
(C) Amphibians (D) Either (B) or (C).
- Frogs breathe through their _____ when in water.
(A) Lungs (B) Gills
(C) Moist skin (D) Spiracle
- Whales and dolphins are mammals and not fish because
(A) They have fins
(B) They live in water
(C) They breathe through lungs
(D) They have streamlined body.
- Vulture and hyena feed on dead animals. They are called
(A) Herbivores (B) Omnivores
(C) Scavengers (D) Predators.
- The air holes of grasshopper are called
(A) Gills (B) Spiracles
(C) Nose (D) Wind pipe.

1.5 MOVEMENTS IN ANIMALS

Ability to move from place to place is called **locomotion**. It helps animals to search for food, protect themselves from enemies, etc.

Animals that Move on Land

Animals can stand upright and walk on their hindlimbs (humans), both hindlimbs and forelimbs

(horse, deer, leopard, etc.), hop and jump on their hindlimbs (kangaroo, rabbit, etc.), crawl on the ground (crocodile, lizard, etc.) and slither (snake).





Rabbit

Kangaroo

Hopping



Snake

Slithering

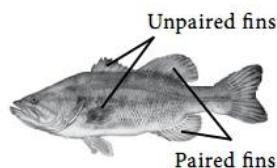


Lizard

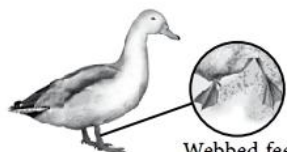
Crawling

Animals that Swim

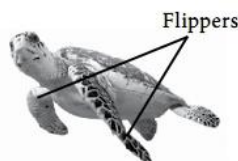
Animals living in water swim with the help of their fins (fish), webbed feet (duck, swan, etc.) and flippers (sea turtles and penguins).



Fish



Duck



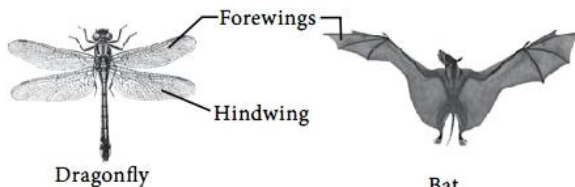
Sea Turtle

Animals that can swim

Animals that Fly

Aerial animals use their wings to fly. In birds, e.g., eagle, pigeon, sparrow, etc., wings are actually modified forelimbs. Birds have strong flying muscles attached to their wings that help them to fly. Bats also possess wings for flying. Bat wings are modified tetrapod forelimbs.

Insects, e.g., butterfly, housefly, honeybee, etc. have forewings and hindwings made up of scales that help them to fly.



Dragonfly

Bat



Parakeet

Animals that can fly



Olympiad Bite

Insect wings lack bones but bat and bird wings have them. Insect wings are covered with scales, bat wings with bare skin and bird wings with feathers.

1.6 ADAPTATIONS IN ANIMALS

Adaptation is the adjustment of organisms to their environment in order to improve their chances of survival in that environment. Different types of adaptations are discussed as follows :

Migration

Migration refers to long distance movement of animals to escape unfavourable conditions.

- Arctic tern travels from Arctic region to Antarctic region and back again each year. The average round trip length of these birds is 71, 000 km making this the longest migration of any animal in the world.



Arctic tern

- Humpback whale travels from Antarctica to their tropical breeding ground in coastal water of Australia by covering a distance of 5000 km.



Humpback whale

- Locusts are the most destructive migratory insects. They form swarms and travel approximately 5-130 km/day and destroy crops that come in their way.



Locust

- Monarch butterflies migrate from Canada to Mexico where they cluster together from late October through March. At least five generations make this annual migratory cycle.



Monarch butterfly

- Salmon migrate from sea to freshwater to breed. After breeding they die. Young salmon hatch out from eggs and start migration to sea from fresh water.



Salmon

- Eels migrate in the reverse direction of salmon. They live most of their lives in freshwater river and migrate to sea for breeding. They hatch in the sea and migrate back to freshwater.



Eel

Camouflage

The ability of an organism to blend with its surroundings so that it gets unnoticed from its prey and predator is called **camouflage**.

Chameleon changes colour to blend with the surroundings. Polar bear has white fur so it easily blends with the white snowy background.

Mimicry

Mimicry is a phenomenon wherein an organism resembles another organism or some inanimate object to such an extent that they look alike. It is a device to protect oneself from predators or to easily catch prey.

Some insects like Viceroy butterfly mimics Monarch butterfly to protect itself from predators. Leaf insect mimics leaves of plants to remain unnoticed by prey and predators.

SELF TEST - 3

1. I am a bird, but I cannot fly. I run very fast and I have long legs. Who am I?

- (A) Peacock (B) Ostrich
(C) Owl (D) Duck

2. Locusts are harmful migratory

- (A) Birds (B) Rodents
(C) Fish (D) Insects.

3. Match the organs that help in locomotion of the animal.

Column I

- (P) Fish
(Q) Frog
(R) Turtle
(S) Octopus

Column II

- (i) Arms
(ii) Paddle-like limbs
(iii) Webbed feet
(iv) Fins

- (A) P-(iii), Q-(iv), R-(ii), S-(i)
(B) P-(iv), Q-(iii), R-(ii), S-(i)
(C) P-(iii), Q-(iv), R-(i), S-(ii)
(D) P-(iv), Q-(iii), R-(i), S-(ii)

4. _____ cranes migrate to India every winter.

- (A) Arctic (B) European
(C) American (D) Siberian

5. Type of movement shown by animal in the picture is



- (A) Walking (B) Hopping
(C) Slithering (D) Crawling.

EXERCISE

1. On the basis of habitat, koala belongs to (i) group whereas bat belongs to (ii) group.

(i)

(A) Arboreal

(B) Aerial

(C) Terrestrial

(D) Terrestrial

(ii)

(A) Aerial

(B) Arboreal

(C) Aerial

(D) Arboreal

2. Refer to the given list of few animals.

Lizard, Snake, Frog, Earthworm, Fish, Crocodile

How many of these breathe through moist skin?

(A) 3

(B) 2

(C) 4

(D) 1

3. Select the correct option that on unscrambling gives the name of the network of tubes in insects that help in aeration of body tissues.

(A) EOSN

(B) UGLNS

(C) PRALSICSE

(D) ERAHTCEA

4. Select the odd one out on the basis of eating habits.

(A) Human

(B) Bear

(C) Chimpanzee

(D) Snake

5. Select the incorrect statement.

I. During breathing oxygen is taken in and carbon dioxide is given out.

II. Amphibians and reptiles breathe through moist skin.

III. Swallow is a flightless bird.

IV. Locusts are most destructive migratory insects.

(A) I and II

(B) II and III

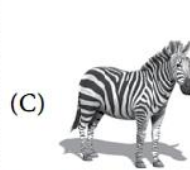
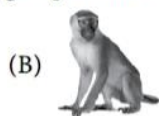
(C) II and IV

(D) I, II and IV

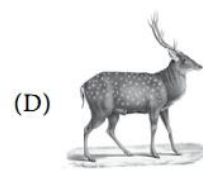
6. Select odd one out on the basis of body covering.



7. On the basis of habitat, which of the following animals belongs to the same group to which sloth belongs?

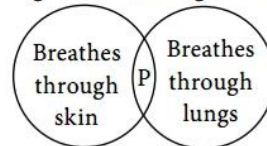


(C)



(D)

8. Refer to the given Venn diagram. P could be



(A) Dolphin

(B) Fish

(C) Earthworm

(D) Frog.

9. Select the incorrect match.

(A) Crawl – Lizard

(B) Slither – Kangaroo

(C) Hop – Rabbit

(D) Run – Horse

10. In order to escape unfavourable conditions 'X' makes the longest migration of any animal in the world. 'X' refers to



(A)



(B)



(C)



(D)

11. Unscramble the given letter groups to get the name of adaptation shown by leaf insect.

(A) E T V T A O I I S A N

(B) M R I M C I Y

(C) O I A M R I G T N

(D) A I E N H R I B T O N

12. Match column I with column II and select the correct option.

Column I

Column II

(i) Armadillo

(a) Scale

(ii) Lizard

(b) Feather

(iii) Polar bear

(c) Bony armour

(iv) Emu

(d) Fur

(A) (i)-(a); (ii)-(c); (iii)-(b); (iv)-(d)

(B) (i)-(c); (ii)-(a); (iii)-(d); (iv)-(b)

(C) (i)-(b); (ii)-(a); (iii)-(d); (iv)-(c)

(D) (i)-(c); (ii)-(b); (iii)-(d); (iv)-(a)

13. Select the option in which all members are correctly grouped on the basis of their eating habits.

- (A) Chimpanzee, Bear, Crow
- (B) Rabbit, Cow, Deer
- (C) Eagle, Tiger, Shark
- (D) All of these

14. Read the given statements and select the option that correctly states them as true (T) and false (F) ones.

- (i) Wings of housefly and honeybee are made up of scales.
- (ii) Ducks and penguins swim with the help of their webbed feet.
- (iii) Crocodile and snake crawl on the ground.
- (iv) Sharks, whales and dolphins breathe through blowholes.

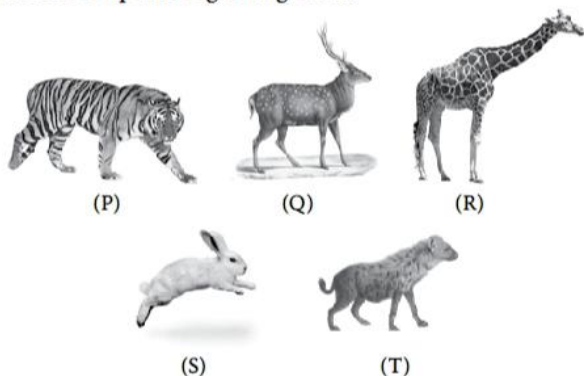
- | | (i) | (ii) | (iii) | (iv) |
|-----|-----|------|-------|------|
| (A) | T | F | T | T |
| (B) | T | T | F | F |
| (C) | T | F | F | F |
| (D) | F | F | T | F |

15. Select the incorrect pair.

- (A) Arboreal – Woodpecker
- (B) Aquatic – Sea horse
- (C) Amphibian – Salamander
- (D) Aerial – Walrus

Achievers Section (HOTS)

16. Refer to the animals shown here and select the incorrect option regarding them.



- (A) Q and R have sharp front teeth for cutting and flat back teeth for grinding.
- (B) Bodies of P and T are covered with fur.
- (C) P and T are carnivores whereas Q, R and S are herbivores.
- (D) P, Q and R are terrestrial animals whereas S and T are arboreal animals.

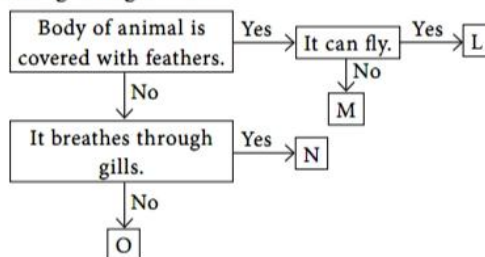
17. Read the given passage regarding types of body covering where few words have been italicised.

Body of *amphibians* and reptiles is covered with scales. Scales are *soft* and overlapping structures that do not let water enter the body of animals. Some *insects* also have scales.

Select the incorrect option regarding this.

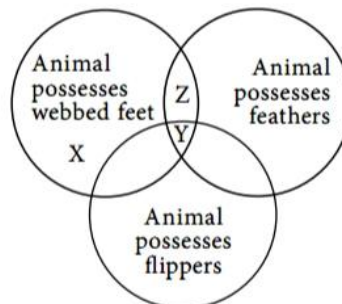
- (A) *Amphibians* must be replaced by *fishes*.
- (B) *Soft* should not be replaced as it is correctly mentioned.
- (C) *Insects* should not be replaced as it is correctly mentioned.
- (D) Both (B) and (C).

18. Refer to the given flow chart and select the incorrect option regarding L – O.



- (A) L could breathe through lungs whereas O could breathe through skin.
- (B) M could be a warm blooded animal whereas N could be a cold blooded animal.
- (C) L could be penguin and M could be duck.
- (D) O could probably be an animal like a reptile or a mammal.

19. Refer to the given Venn diagram and select the option that correctly identifies animals X, Y and Z.



- | X | Y | Z |
|-------------|---------|------|
| (A) Frog | Penguin | Duck |
| (B) Penguin | Duck | Fish |
| (C) Duck | Fish | Swan |
| (D) Swan | Frog | Fish |

20. Identify one odd member in each group based on body covering and select the correct statement.

Group I : Snake, Crocodile, Snail, Lizard

Group II : Polar bear, Arctic fox, Penguin, Rabbit

Group III : Shark, Guppy, Porcupine, Rohu

Group IV : Hilsa, Walrus, Whale, Dolphin

- (A) Crocodile of group I should be replaced with frog.
 (B) Penguin of group II must be replaced with tiger.
 (C) Porcupine of group III must be replaced with oyster.
 (D) Walrus of group IV must be replaced by Jellyfish.

SOF NSO 2018 QUESTIONS

1. Refer to the given relationship based on body coverings and select the option which satisfies the same relationship.

Parakeet : Armadillo : Opossum

- (A) Partridge : Turtle : Rabbit
 (B) Egret : Flamingo : Hedgehog
 (C) Porcupine : Oyster : Lizard
 (D) Whale : Crab : Tortoise (Level-1)

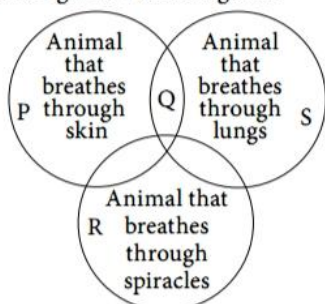
2. Read the given paragraph.

X and Y are animals which possess backbone and flippers and breathe through lungs. X lays egg whereas Y gives birth to young ones.

Select the option which correctly identifies X and Y.

- | X | Y |
|-------------|-----------|
| (A) Turtle | Platypus |
| (B) Frog | Porcupine |
| (C) Penguin | Dolphin |
| (D) Seal | Whale |
- (Level-1)

3. Refer to the given Venn diagram.



Select the option which correctly identifies P-S.

- | P | Q | R | S |
|---------------|-----------|--------|-------------|
| (A) Beetle | Leech | Parrot | Cockroach |
| (B) Frog | Lizard | Fish | Crow |
| (C) Earthworm | Frog | Beetle | Snake |
| (D) Amoeba | Crocodile | Lizard | Grasshopper |
- (Level-1)

4. Refer to the given table and select the option that correctly identifies P, Q and R.

Characteristics	Animals		
	P	Q	R
It can swim.	Yes	Yes	Yes
It lays egg.	Yes	No	Yes
It possesses blubber.	Yes	Yes	No

- | P | Q | R |
|----------------|------------|---------------------|
| (A) Dolphin | Whale | Penguin |
| (B) Polar bear | Dolphin | Duck |
| (C) Penguin | Polar bear | Duckbilled platypus |
| (D) Duck | Penguin | Whale |
- (Level-1)

5. Swati made four groups each with two organisms with similar kind of body covering, but she made one mistake while pairing organisms in one of the groups. Select the incorrect group.

- (A) Crocodile, Snake
 (B) Parakeet, Emu
 (C) Turtle, Crab
 (D) Pigeon, Bat (Level-1)

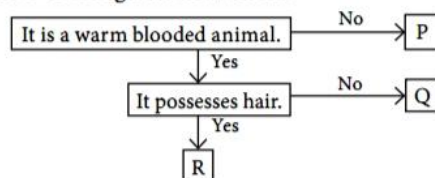
6. Read the given features of animal X.

- (i) Forelimbs are adapted for flying.
 (ii) Body is covered with feathers.
 (iii) Light and hollow bones.
 (iv) Streamlined body.

X could be

- (A) Penguin (B) Bat
 (C) Krait (D) Pigeon. (Level-1)

7. Refer to the given flow chart.



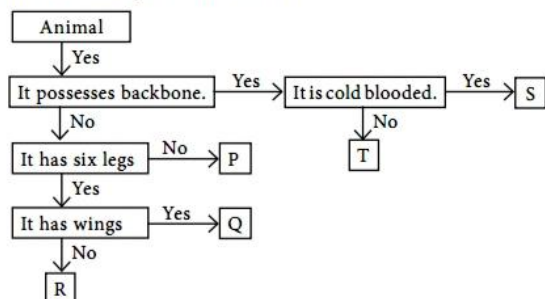
Select the option which correctly identifies P, Q and R.

- | P | Q | R |
|----------------|----------|----------|
| (A) Parakeet | Snake | Lizard |
| (B) Polar bear | Walrus | Eagle |
| (C) Frog | Swallow | Hedgehog |
| (D) Rabbit | Platypus | Kite |
- (Level-1)

8. Select the odd one out on the basis of body covering.

- (A) Cassowary
 (B) Chameleon
 (C) Python
 (D) None of these (Level-1)

9. Refer to the given flow chart and select the option which correctly identifies P-T.



- | P | Q | R | S | T |
|----------------|-----------|------------|-------------|------------|
| (A) Mosquito | Ostrich | Guppy fish | Earthworm | Silverfish |
| (B) Guppy fish | Mosquito | Earthworm | Silver fish | Ostrich |
| (C) Silverfish | Earthworm | Guppy fish | Ostrich | Mosquito |
| (D) Earthworm | Mosquito | Silverfish | Guppy fish | Ostrich |

(Level-1)

10. Given below are some adaptations shown by animals.

- Large sized ears
- Thick fur on the body
- Thick layer of fat under the skin
- Aestivation
- Hibernation

Which of these adaptations can be found in animals living in polar regions?

- (A) (ii), (iii) and (v) only (B) (iii), (iv) and (v) only
(C) (ii), (iii) and (iv) only (D) (i), (ii) and (iii) only

(Level-2)

11. Which of the following matches are incorrect?

- | | | |
|-----------------|---|------------------|
| (i) Blowholes | - | <i>Scoliodon</i> |
| (ii) Moist skin | - | Earthworm |
| (iii) Spiracles | - | Honeybee |
| (iv) Gills | - | Adult frog |
| (v) Lungs | - | Pigeon |

- (A) (ii), (iii) and (v) only
(B) (i), (ii) and (v) only

(C) (iii), (iv) and (v) only

(D) (i) and (iv) only

(Level-2)

12. On the basis of body covering, Mohit made four groups of three organisms each. In an attempt of doing so, he classified organisms incorrectly in one of the groups. Identify this group and select the correct option.

- (A) Tortoise, Snail, Oyster
(B) Fish, Snake, Lizard
(C) Penguin, Ostrich, Bat
(D) Hippopotamus, Whale, Cow

(Level-2)

13. Refer to the given figures X, Y and Z and select the correct option.



- (A) They all possess similar respiratory organs.
(B) They all possess similar body coverings.
(C) They all possess flippers to swim in water.
(D) They all possess hollow bones to make the body light.

(Level-2)

14. Ruchi categorised animals on the basis of their body coverings. She made three groups and by mistake placed one wrong member in each group. Identify the wrong member of each group and select the correct option.

Group I – Snake, Lizard, Crab

Group II – Sloth, Platypus, Salmon

Group III – Penguin, Pigeon, Grasshopper

- (A) Crab of group I should be interchanged with grasshopper of group III.
(B) Salmon of group II should be replaced with toad.
(C) Platypus of group II should be interchanged with pigeon of group III.
(D) Grasshopper of group III should be replaced with parakeet.

(Level-2)

HINTS & EXPLANATIONS

SELF TEST - 1

1. (C): In the given flow chart, animals have been classified on the basis of habitat. Fish is aquatic, frog is amphibian (on land and in water), lizard is terrestrial, bird is aerial and the last category is arboreal where monkey can be placed.
2. (B)
3. (B): Exoskeleton in snail and turtle comprises of hard covering called shell.
4. (D): Bird (eagle), bat and butterfly are aerial animals.
5. (D): Animal X is butterfly whose body is covered with cuticle.

SELF TEST - 2

1. (B): Rabbits, rats and squirrels are rodent mammals.
2. (C): Frogs are amphibians capable of living both on land and in water. They breathe through lungs when present on land while in water they breathe through their moist skin.
3. (C) 4. (C)
5. (B): Insects e.g., grasshopper have spiracles on their body surface through which they breathe.

SELF TEST - 3

1. (B)
2. (D): Locusts are harmful migratory insects that travel in swarms and destroy the crop that come in their way.
3. (B)
4. (D): A group of Siberian cranes is believed to breed in western Siberia. These cranes spend the winters in India.
5. (D): The animal shown in the picture is snake. It slithers on ground.

EXERCISE

1. (A): Koala is an arboreal animal whereas bat is an aerial animal.
2. (B): Among the given animals, lizard, snake and crocodile breathe through lungs. Fish breathe through gills and frog breathes through lungs when on land and moist skin when in water. Earthworm breathes through its moist skin.
3. (D): Option (A) is NOSE, option (B) is LUNGS option (C) is SPIRACLES and option (D) is TRACHEAE.

Spiracles are the openings in insects body that lead to network of tubes called trachea which help in aeration of body tissues.

4. (D): Human, bear and chimpanzee are omnivores whereas snake is carnivore.
5. (B): Amphibians may breathe through moist skin but they also have lungs to breathe. Reptiles have lungs as breathing organs. Swallow is a flying bird.
6. (A): Cuticle is present in the body coverings of grasshopper, cockroach and ant. Skin of frog is smooth and without scales.
7. (B): Sloth is an arboreal animal and so is monkey.
8. (D): Frog can breathe through lungs as well as skin.
9. (B): Kangaroo hops whereas snake slithers.
10. (C): X refers to Arctic tern which is a migratory bird that shows longest migration. This tiny bird flies 71000 km from its breeding ground in Arctic to Antarctic and back again clocking the longest migration recorded.
11. (B): Leaf insect mimics leaf of plants to remain unnoticed from prey as well as predator. Option (A) is AESTIVATION, option (B) is MIMICRY, option (C) is MIGRATION and option (D) is HIBERNATION. So, option (B) is the correct answer.
12. (B) 13. (D)

14. (B): Crocodile crawls on the ground but snake slithers on the ground.

Sharks breathe through gills as they are fishes whereas whales and dolphins are mammals and breathe through lungs. They have blow holes for taking in and giving out air.

15. (D): Walrus is a large Arctic marine mammal with flippers, broad head, small eyes, tusks and whiskers.
16. (D): All P, Q, R, S and T are terrestrial animals. P is tiger, Q is deer, R is giraffe, S is rabbit and T is hyena.
17. (B): Body of fishes and reptiles is covered with scales. Scales are *hard* and overlapping structures that do not let water enter the body of animals. Some *insects* also have scales. They are present in their wings.
18. (C): In the given flow chart L is a flying bird, M is a flightless bird, N is a fish whereas O could be any animal like a reptile or a mammal.
19. (A): Frog has webbed feet to enable it to swim in water. Penguin possesses webbed feet, flippers as well as feathers. Duck has webbed feet and feathers only.

20. (B) : Group I includes those animals which have scales like snake, crocodile and lizard. Here snail is the odd one which possesses shell as outer covering. Group II includes animals which possess fur like polar bear, Arctic fox and rabbit. Here penguin is the odd one which possesses feathers as outer body covering. Group III includes fishes like shark, guppy and Rohu which possess scales. Porcupine is the odd member as it possesses hair and spines. Group IV includes those animals which possess hair like whale, walrus and dolphin. Hilsa is the odd member as it is a fish and possesses scales.

SOF NSO 2018 QUESTIONS

1. (A) : The relationship in the given box shows body coverings of feathers (parakeet), shell (armadillo) and hair (opossum). Similarly body covering of partridge is feather, of turtle is shell and of rabbit is hair.
2. (C) : Penguin and dolphin both possess backbone and flippers. They both breathe through lungs. Penguin is a bird that lays eggs. Dolphin is a mammal that gives birth to young ones.
3. (C) : Earthworm (P) breathes through skin, Frog (Q) breathes through both lungs and skin, beetle breathes through spiracles and snake (S) breathes through lungs.
4. (C) : Penguin is a bird that can swim and possess blubber to protect itself from excessive cold. It lays eggs. Polar bear is a good swimmer and has blubber to keep itself warm. It is a mammal and gives birth to young ones. Duck billed platypus is an egg laying mammal. It is semi-aquatic animal and is a good swimmer.
5. (D) : Pigeon has body covering of feathers while bat has body covering of hair.
6. (D) : The animal described here could only be a bird. Krait is a reptile and bat is a mammal. Penguin is a bird but its forelimbs are modified as flippers making it a good swimmer. It is a flightless bird. Pigeon is the right answer as it a flying bird and has all the characteristics listed in the question.

7. (C) : According to the given flow chart, Q could be a bird and R could be a mammal. P could be any animal like a fish, an amphibian a reptile etc.

P could be frog (amphibian), Q could be swallow (bird) and R could be hedgehog (mammal).

8. (A) : Cassowary is a bird having outer body covering of feathers whereas chameleon and python are reptiles and possess scales.

9. (D) : In the given flow chart, T and S are animals with backbone but S is cold blooded so it could be amphibian, fish or reptile but T is warm blooded so it could be mammal or bird.

P, Q and R are animals without backbone. Q and R are insects as they have six legs but Q is a flying insect and R is a non-flying insect.

P could be earthworm which has no backbone and no legs.

10. (A) : Animals living in polar regions possess thick layer of fat under the skin and thick fur on the body to keep them warm in extremely cold weather of polar region. Polar animals pass the harsh winter months by undergoing winter sleep or hibernation.

11. (D)

12. (C) : Penguin and ostrich are birds and so they have feathers as outer coverings of body whereas bat is a mammal and possesses hair.

13. (A) : X (duck), Y (turtle) and Z (penguin) breathe through lungs. Duck and penguin have feathers whereas turtle has shell. Turtle has flippers, penguin has both webbed feet and flippers whereas duck has webbed feet to swim in water. Duck has hollow bones as an adaptation for flight.

14. (D) : Animals in group I have scales as outer body covering where crab is the odd one out having shell as outer covering.

Animals of group II have hair as outer body covering except salmon which possesses scales.

Animals of group III have feathers as outer body covering except grasshopper which possesses cuticle.



Human Body and Health

Learning objectives

2.1 The skeletal and muscular system

2.2 The nervous system

2.3 Food and health

2.4 Diseases and their prevention

2.5 Safety and first aid

Our body is composed of many **cells**. The cells performing a common function forms a **tissue**. The different types of tissues carrying out the specific function form an **organ**. A group of organs work together to form an **organ system**. Different organ systems together make up an **organism**.

Cell → Tissue → Organ → Organ system → Organism

Our body has many organ systems *i.e.*, digestive system, skeletal system, muscular system, nervous system, circulatory system, respiratory system, etc., which work like very efficient machines.

2.1 THE SKELETAL AND MUSCULAR SYSTEM

Skeletal System

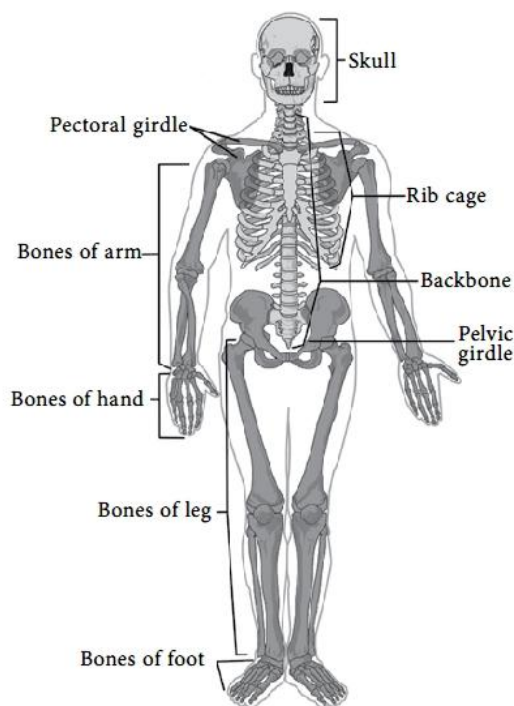
The skeletal system is the framework of bones that gives shape and support to our body.

A new born baby has about 300 bones. These fuse to form 206 bones in an adult human skeleton. Bones are made up of minerals like calcium and phosphorous. They contain a soft tissue called **bone marrow** where the new blood cells are produced.

The primary functions of the skeleton system are:

- It gives shape to our body.
- It helps to protect our internal organs.
- It provides the basic structure for muscles to attach themselves, so that our bodies are able to move.
- Most of the blood cells are produced inside some bones.

The human skeleton consists of the skull, backbone, ribcage and two pairs of limbs and two pairs of girdles.



Human skeletal system



Olympiad Bite

Though bones are very hard, they are not the hardest in our body. Enamel coating on our teeth is harder than bones.

Skull

Skull protects the brain. It consists of 22 bones, out of these 8 bones protect the brain (cranial bones) and the remaining 14 bones make up the face (facial bones). Except the lower jaw, all the bones of the skull are fixed. Lower jaw is movable, thus it enables us to eat, drink and talk.

Backbone

Backbone consists of 33 small bones called **vertebrae** which form a column called the **vertebral column**. It protects the spinal cord.

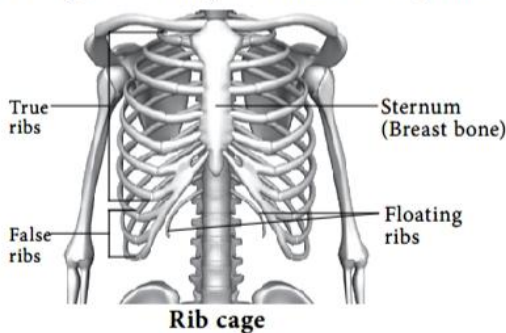
Vertebrae are like hollow beads through which spinal cord runs like a string. The backbone is joined to the skull, girdles and ribs. The first bone of the backbone is called **atlas** and the last bone is called **tail bone**, as it has tapering end.



Backbone

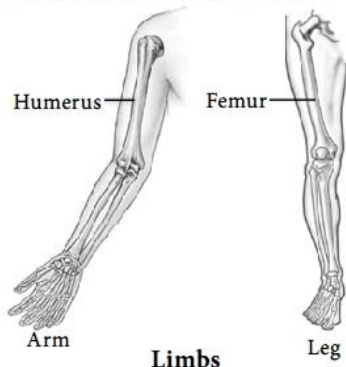
Rib cage

Ribs are thin, flat and curved bones. Rib cage has 12 pairs of ribs which enclose the heart, lungs and kidneys. The first seven pairs of ribs are attached directly to the breast bone (long bone in the centre of the chest). They are called **true ribs**. Next three pairs of ribs are attached to the ribs above them. They are called **false ribs**. The last two pairs of ribs are joined only to the backbone and remain free in the front of the ribcage, hence they are called **floating ribs**.



Limbs

Human body has two pairs of limbs : **forelimbs** or **arms** and **hindlimbs** or **legs**. Each arm and each leg has 30 bones which comprise different kinds of bones. **Humerus** is the longest bone in the forelimb. Wrist is composed of eight small bones, arranged in two rows. The longest, strongest and largest bone of the body is in the hindlimb. It is the thigh bone, called **femur**. Each foot has a number of small bones.



Girdles

Pectoral girdle or shoulder girdle and **pelvic girdle** or hip girdle are two pairs of girdles present in human body.

The upper limbs are attached to the pectoral girdle and the lower limbs are attached to the pelvic girdle.



Pectoral girdle



Pelvic girdle

Joints

A joint is where two or more bones meet. Joints help our bones to move. There are movable and immovable joints in our body. Joints in the skull are immovable while all other joints are movable. In the movable joints, bones move smoothly because of a fluid which acts like a lubricant. There are four kinds of movable joints in our body.

Hinge joint

This type of joint works like hinges in a door. Bones in the knee, elbow, finger and toes have this type of joint. Hinge joint allows movement in one direction only.



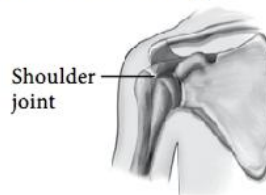
Elbow joint



Knee joint

Ball and socket joint

In this joint, the ball-like end of one bone fits into a cup-like end (socket) of other bone. This type of joint allows movement in all directions. Shoulder and hip joints are of this type.



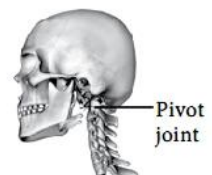
Shoulder joint



Hip joint

Pivot joint

This type of joint is found between the first two vertebrae (atlas and axis) of the backbone. It allows head to turn sideways.



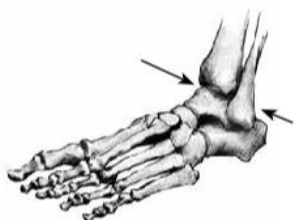
Pivot joint

Gliding joint

This joint allows the bones to glide over each other *i.e.*, back-and-forth and side-to-side movement. This type of joint is found in the bones of wrist and ankle.



Wrist joint



Ankle joint



Olympiad Bite

Ligament is a strong and elastic tissue that binds bone to another bone. Ligaments hold the joints together. Tendon is a stretchy tissue that attaches muscle to bone.

Muscular System

There are over 600 muscles spread all over our body. They are attached to the bones by strong fibres called **tendons**. Some muscles are present in organs like heart and stomach also. Muscles help body parts to move and also give us strength to do work. Cells that make up muscles are contractile in nature.



Muscular system

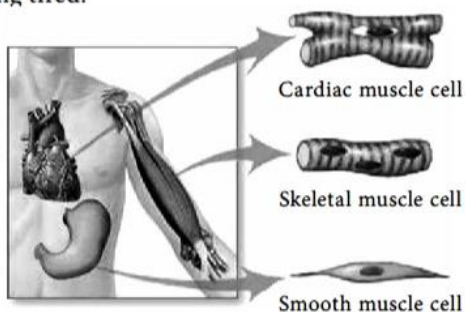
Types of muscles

Our muscular system consists of three types of muscles in our body :

Skeletal muscles – Muscles that are connected to bones and are under our control are called **skeletal muscles** or **voluntary muscles**. These muscles are also called **striped** or **striated muscles** because they have **stripes** on them. These muscles are present in our arms, legs, hands and feet.

Smooth muscles – Muscles that are not under our control are called **smooth muscles** or **involuntary muscles**. These muscles are controlled by the brain and the spinal cord. They do not have any stripes, hence they are called **smooth muscles**. Muscles present in stomach are examples of smooth muscles.

Cardiac muscles – Our heart is made up of a special kind of tough muscle called **cardiac muscle**. These muscles are also involuntary in nature but have stripes on them and work throughout our lifetime without getting tired.



Types of muscles

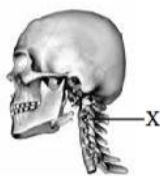
Working of muscles

When the cells of a muscle contract, the muscle becomes shorter. The muscle returns to its original length when the cells relax.

Muscles on contracting can only pull the bones. They cannot push the bones. Hence, muscles work in pairs. For example, biceps and triceps work against each other to bend the arm up and down.

SELF TEST - 1

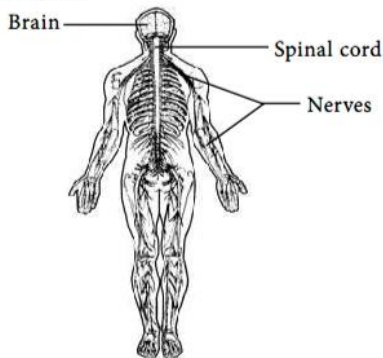
- 'X' is a
(A) Hinge joint
(B) Ball and socket joint
(C) Pivot joint
(D) Gliding joint.
- How many bones make up the human skull?
(A) 22 (B) 28
(C) 21 (D) 25
- Select the incorrect statement.
(A) Last 3 pairs of ribs are called floating ribs.
(B) Human body has 14 facial bones.



- (C) Rib cage has 12 pairs of ribs.
(D) Adult human has 206 bones in his skeleton.
- Cardiac muscles are _____.
(A) Striated
(B) Non-striated
(C) Voluntary
(D) Both (B) and (C)
- Joint present in hip and shoulder is _____ joint.
(A) Gliding (B) Pivot
(C) Ball and socket (D) Immovable

2.2 THE NERVOUS SYSTEM

Our nervous system helps us to be aware of our surroundings. It helps us to think, learn and remember. It controls the activities of all the other organ systems in our body. Nervous system consists of brain, spinal cord and nerves.



Nervous system

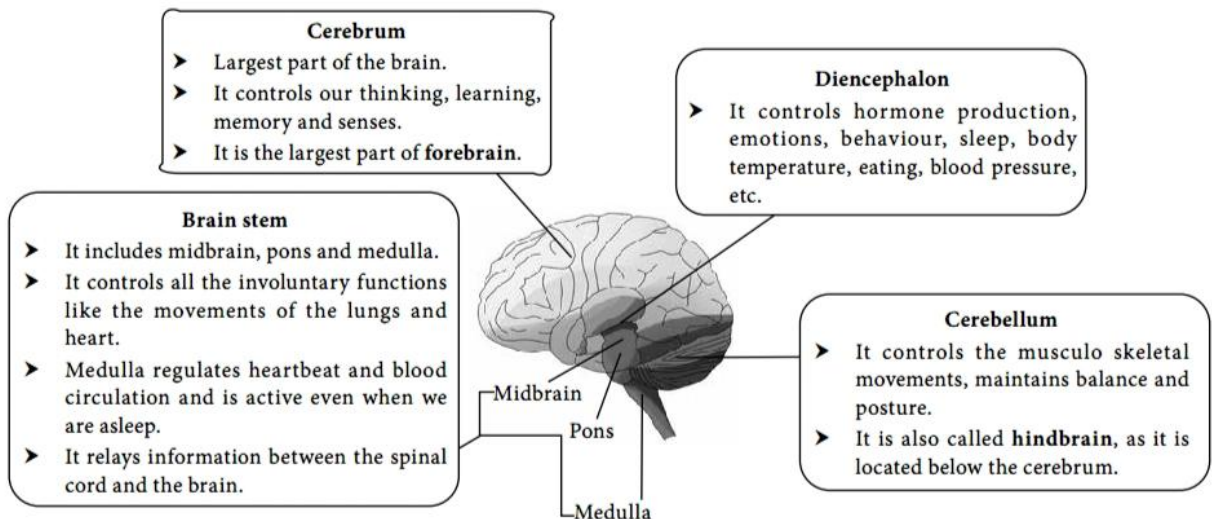
Brain

Brain is the control centre of the human body. It receives information from all the parts processes them and sends instructions to the body through different nerves. Brain is protected by hard and bony skull. Between the skull and brain, there is a fluid which acts as a shock absorber.

The functions of brain are :

- It co-ordinates and controls body processes like breathing, digestion, heart beat, etc.
- It controls body movements.
- It enables us to think, learn, memorise and apply logic.

There are various parts of the brain that have different functions.



Parts of the brain and their functions

Spinal Cord

Spinal cord is a thick cord of nerves which extend from the medulla to almost the lower end of the backbone. It connects rest of the body to the brain through the nerves and carry information between the brain and all parts of the body. Spinal cord also controls the reflex actions. The vertebral column protects the spinal cord.



Spinal cord

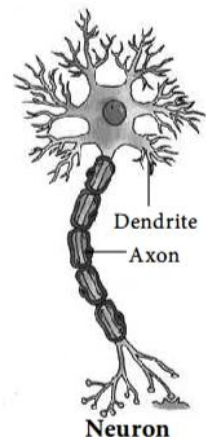
Nerves

Nerves are thread-like structures that transmit messages between the brain and the body. Nerves from

the head and neck join the brain directly and nerves from the rest of the body join in the spinal cord. The spinal cord leads to the brain.

Nerves are made up of many **nerve cells** or **neurons**. There are three types of nerves:

Sensory nerves – These nerves carry messages from different parts of the body to the brain or to the spinal cord.

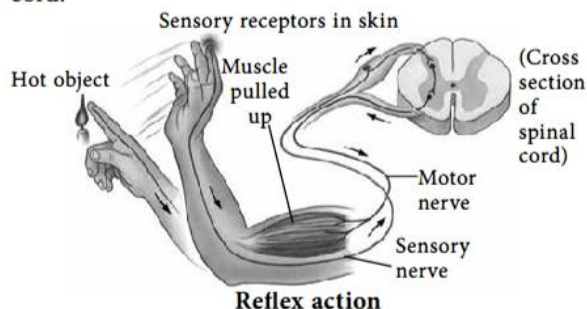


Motor nerves – These nerves carry messages from the brain or the spinal cord to the muscles or glands.

Mixed nerves – These nerves carry messages both ways, *i.e.*, carry messages to the brain as well as carry instructions from the brain to other parts of the body.

Reflex Action

Reflex action is an involuntary and sudden response to a stimulus. Such actions are controlled by the spinal cord.



Reflex action

For example, when we touch a hot object, the sensory nerves immediately pass a message to the spinal cord. The spinal cord sends orders through the motor nerves

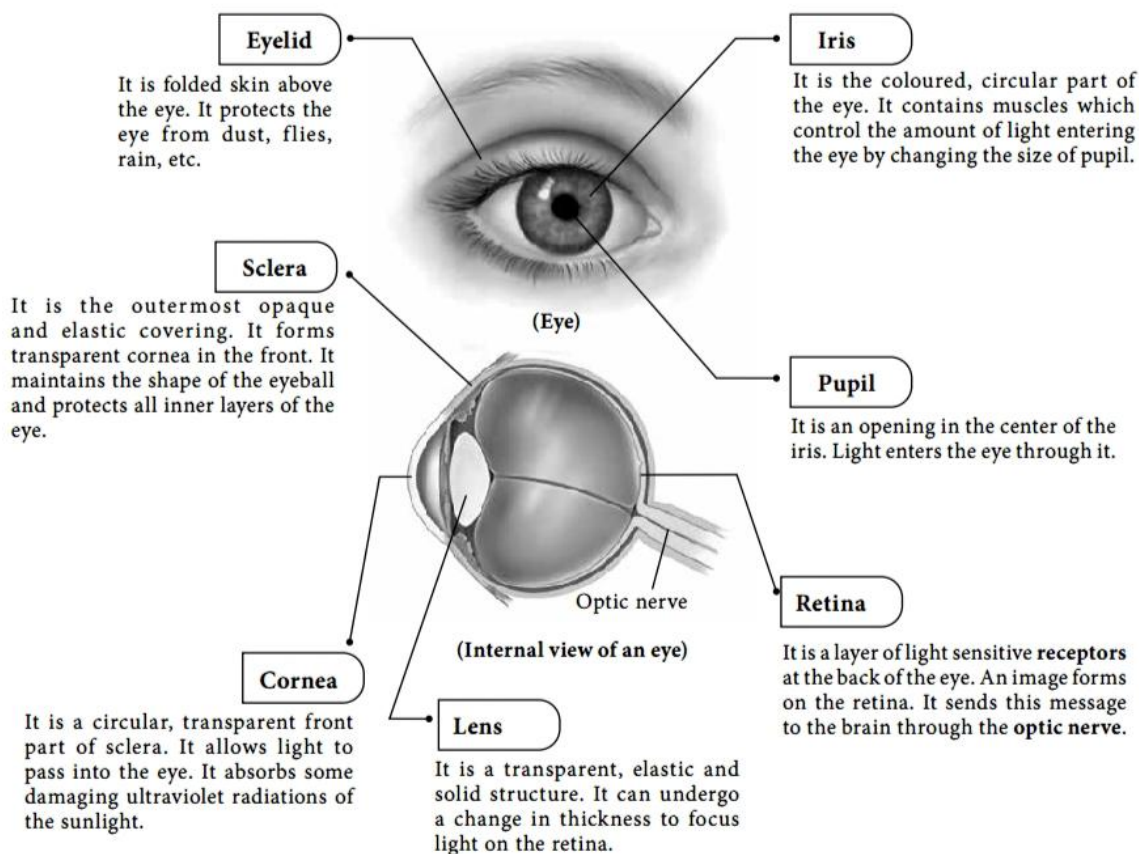
for the muscles to tighten up. We pull our hand away from the hot object even before we feel the pain. Other examples of reflex action are blinking of the eyes, watering of the mouth, etc.

Sense Organs

The organs which connect us to the outside world are known as **sense organs**. We have five sense organs—eyes, ears, nose, tongue and skin which are responsible for sight, sound, smell, taste and touch respectively. These organs collect information and send it to the brain through sensory nerves. The brain then interprets the information and tells us what we have sensed.

Eyes

Eyes are the most important sense organs. They are the organs for sight. Each eye consists of an **eyeball**, set in a hollow socket of the skull. The eyeballs are filled with a fluid that protects the eye from shocks and minor jerks. They are further protected by eyelids and eyelashes. Eyelids and eyelashes keep the eyes clean and dust free. An eye consists of various parts.



Parts of an eye and their functions

Taking care of the eyes

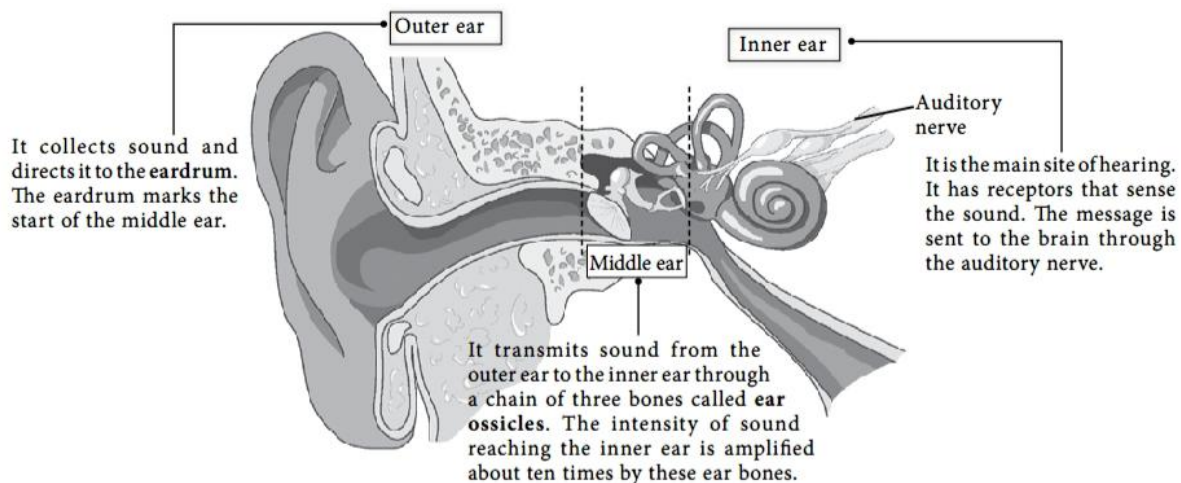
It is very important to take good care of the eyes.

- Wash your eyes regularly with clean water.
- Do not work in dim light or very bright light. This tires the eyes. Let the light fall from the left side of the reading material.
- Do not read in a moving vehicle. This will strain your eyes.
- Do not rub your eyes if they are itching. Wash your eyes with clean, cold water and see a doctor.
- Do not use someone else's towel or handkerchief to clean your eyes as this can cause infection.

- Watch the television from a distance of at least 6 feet. Do not play games on a computer or other gadgets for a long time. This causes eye strain and can affect your vision.
- Tell your teacher or parent if you cannot read what is written on the blackboard.

Ears

Ears are the organs of hearing, and help to maintain our balance. An ear consists of three main parts - outer ear, middle ear and inner ear.



Parts of an ear and their functions

Taking care of the ears

Take care of your ears by following these tips :

- Dry your ears well after taking bath.
- Never clean your ears with pointed objects like a matchstick or a hairpin. You may injure the eardrum inside.
- Take care while swimming. Water should not enter your ears. Dry them immediately after swimming.
- See a doctor if you have earache.

- If your nose is blocked due to cold, inhale steam to clear it.

Nose

We breathe and smell through our nose. Nose has receptors in the nasal cavity that help us to smell. The receptors send messages to the brain through the **olfactory nerve**. The brain analyses these messages to know the smell of things. Hair in the nose trap dust and germs and pass the filtered air to the lungs.

Taking care of the nose

- Do not pick your nose.
- Do not clean the nose by putting any object inside it. Gently blow out.

Tongue

Tongue helps us to taste. The surface of the tongue is covered with tiny bumps which have **taste buds**. Taste buds send signal to the brain through nerve endings. Our taste buds can detect sweet, salty, sour and bitter tastes.

Taking care of the tongue

A dirty tongue can cause bad breath and mouth disease. So, it must be kept clean. Whenever you brush your teeth, you must also clean the tongue with a tongue cleaner.

Skin

It is the **largest organ** of our body. It protects the internal organs. It helps us to sense touch, heat, pain and pressure. It is also an excretory organ and allows some body waste to come out as sweat.

Taking care of the skin

- Skin should be kept clean to prevent infections.
- After bathing, dry your skin by rubbing gently with a towel.
- Use a mild soap to bathe.
- Take extra care of the skin around your toes.
- Consult a doctor in case of a skin injury, burn or infection.

SELF TEST - 2

- Reflex actions are controlled by the
(A) Brain (B) Heart
(C) Kidneys (D) Spinal cord.
- Which part of the brain controls our heart beat?
(A) Cerebrum (B) Cerebellum
(C) Medulla (D) All of these
- _____ is the layer of the eye on which the image forms.
(A) Retina (B) Cornea
(C) Sclera (D) Iris
- Which of the following statements is incorrect?
(A) Skin is the largest organ of our body.
(B) Do not read in a moving vehicle.
(C) Use a mild soap to bathe.
(D) None of these.
- Cells that make our nervous system are called
(A) Nerves
(B) Muscles
(C) Ossicles
(D) Neurons.

2.3 FOOD AND HEALTH

Food is one of our basic needs and we need food to survive. To remain healthy, we must eat a **balanced diet**, i.e., all the nutrients in right amounts. Food contains nutrients like carbohydrates, proteins, fats, vitamins and minerals along with roughage and water.

Carbohydrates

Carbohydrates include sugars and starch. They give us energy to do work. Carbohydrates are present in food like rice, potatoes, bread, wheat, sugar, honey, banana, chocolates, candies, etc.

Our digestive system breaks complex carbohydrates i.e., starch and sugar into simpler form, glucose. Glucose is taken by the cells to produce energy.



Sources of carbohydrates

Fats

Fats are also energy giving nutrient, but they give more energy than carbohydrates. Fats can be stored in our body and can be used whenever there is shortage of food. They also help to keep our body warm. Fats are present in foods like butter, dry fruits, vegetable oil, cream and ghee. We should not eat too much of fats as it may lead to overweight or **obesity**. Obesity can further lead to diseases, like heart diseases, diabetes etc.



Sources of fats

Proteins

Proteins are called body-building foods as they help in building muscles and new cells of the body. They also help in repairing worn-out tissues. Foods like eggs, fish, milk, cheese, pulses, soybeans and meat are rich in proteins.



Sources of proteins

Vitamins

Vitamins are essential for our body as they keep us healthy. They are present in fresh fruits and vegetables. They help us fight the disease - causing germs and they are needed in smaller amounts than other nutrients for the normal functioning of our body.



Sources of vitamins

Table : Vitamins, their sources and deficiency diseases

Vitamin	Sources	Deficiency disorder
Vitamin A	Green leafy vegetables, carrot, mango, papaya, tomato, milk, fish and egg yolk. 	Night-blindness (Persons having night blindness have difficulty seeing in dim light.)
Vitamin B ₁	Cereals, milk, meat, peas and green vegetables. 	Beriberi (Affects the nervous system resulting in numbness of hands and feet)
Vitamin C	Citrus fruits, tomatoes, gooseberries, green leafy vegetables and sprouted grains. 	Scurvy (Persons suffering from scurvy have bleeding gums and swollen joints)
Vitamin D	Fish, eggs and mushrooms.  On exposure to sunshine our body makes vitamin D.	Rickets (In children, bones become soft and do not grow well)

Minerals

Just like vitamins, minerals also help in keeping our body healthy. They are also needed in small quantities. Iron, calcium, iodine and phosphorus are some important minerals required by our body.

Table : Minerals, their sources and deficiency diseases

Mineral	Source	Deficiency disorder
Iodine	Iodized salt. 	Goitre (Persons suffering from goitre have swelling in the neck because of improper functioning of thyroid gland present in the neck)
Calcium	Milk, milk products, green leafy vegetables 	Osteoporosis (bones become weak) and tooth decay
Iron	Apples, green leafy vegetables, bananas, guavas, dates, pulses, jaggery, meat, etc. 	Anaemia (The level of haemoglobin in the blood becomes low and does not carry enough oxygen. So, affected person having anaemia looks pale and gets tired easily.)

Roughage

Roughage is the fibre found in vegetables, fruits, outer covering of cereals and pulses. It helps our body to get rid of the waste matter through faeces.

Water

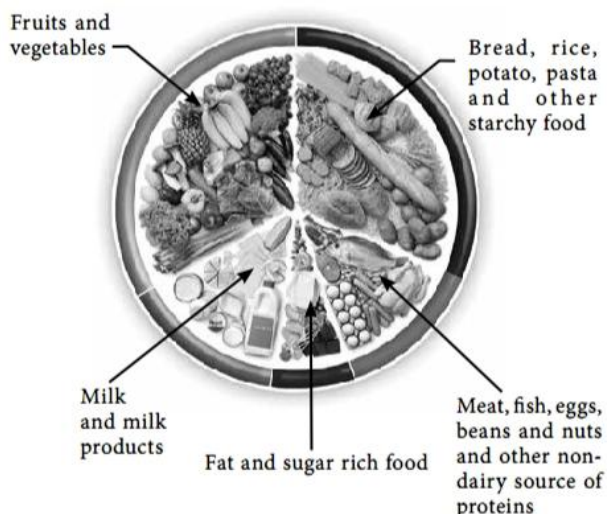
Water is very essential for our body. It forms the part of our blood. It helps to throw away the waste from our body in the form of urine and sweat. We should drink 6-8 glasses of water everyday.

Balanced Diet

A diet that contains adequate amounts of different components of food, along with roughage and water, required for the healthy functioning of our body is called a **balanced diet**.

The nutrients requirement of a person depend on age, gender and the nature of work the person does.

The given pie chart of a balanced diet shows that different foods should be eaten in different sizes. Fruits, vegetables, breads and starchy food should be eaten in great amount, which can be done by taking 5-7 servings of rice and cereals and 2-3 servings of fruits and vegetables. Protein-rich food, whether obtained from dairy products or non-dairy products, like pulses, should be eaten in good amount. 2-3 servings of dairy products and other protein-rich food can be taken. Oil, fat and sugar should be taken in very less amount.



A balanced diet

Exercise and Rest

To stay healthy, we should have an active life. Walking, running, climbing stairs and playing help us stay fit. We need to do exercise regularly. Exercise helps us to build strong bones and muscles, improve blood circulation, maintain good shape, and helps to keep us away from diseases.

We need enough rest to restore our energy and refresh our bodies. Sleep and rest are as important as a balanced diet or exercise. Our body gets time to grow and repair old body cells.

SELF TEST - 3

1. Which of the following is an energy-giving food?

- (A) Soybean
- (B) Orange
- (C) Sugar
- (D) Spinach

2. The child in the picture is suffering from a deficiency disorder where bones and joints do not grow well. Identify this disorder.



- (A) Beriberi
- (B) Goitre
- (C) Rickets
- (D) Scurvy

3. The fruit shown in the picture is rich in



- (A) Calcium
- (B) Iodine
- (C) Vitamin C
- (D) Vitamin D.

4. Goitre is caused by the deficiency of

- (A) Calcium
- (B) Iodine
- (C) Iron
- (D) Vitamin A.

5. Which of the following is a good source of roughage?

- (A) Milk
- (B) Honey
- (C) Cabbage
- (D) Eggs

2.4 DISEASES AND THEIR PREVENTION

Disease is a condition in which our body is not able to function properly. Disease can occur due to many different reasons. Diseases are mainly of two types – non-communicable and communicable.

Non-Communicable Diseases

Non-communicable diseases are diseases that do not spread from an infected person to a healthy person e.g., diabetes, arthritis etc. Some non-communicable

diseases are caused when there is a deficiency of a particular nutrient in our diet. Such diseases are called **deficiency diseases** e.g., scurvy, rickets, anaemia, night blindness, beriberi, etc.

Communicable Diseases

Communicable diseases are diseases that can be passed on from an infected person to a healthy person. Communicable diseases are caused by germs like virus, bacteria, fungi and protozoa.

Table : Communicable diseases and their causative agents

Diseases	Germs
Cold, polio, chicken pox, measles, dengue, chikungunya	Viruses
Plague, tuberculosis, typhoid, pneumonia, whooping cough	Bacteria
Malaria, amoebic dysentery	Protozoa
Ringworm	Fungus

Spread of communicable diseases

Communicable diseases spread through direct contact, infected food, water or air and insect bites.



Olympiad Bite

- Any agent that carries and transmits germs into another living organism is known as vector e.g., insects.
- Malaria is caused by a protozoan which is carried by the female *Anopheles* mosquito. When the mosquito bites a person suffering from malaria, the protozoa are sucked up with the blood. When this mosquito bites a healthy person, the protozoa are injected into the person's blood causing malaria.

By infected air : When a sick person sneezes or coughs, germs spread from his/her nose and mouth. If a healthy person breathes this air, germs enter his or her body

and then cause various diseases like whooping cough, cold, flu, etc.

Through infected food and water : Food and water are contaminated by dirty hands and poor hygiene. Flies, cockroaches carry germs from sewers, and contaminate the food and water. Diseases like typhoid, cholera, diarrhoea, spread through infected food and water.

By direct or indirect contact : Some diseases spread through direct contact or by using the clothes or articles used by the sick person. e.g., cold, chicken pox, measles, ring worm etc.

By insect bites : Blood-sucking insects like mosquitoes, fleas and bugs inject dangerous germs into our blood making us sick. Plague is spread by rat fleas. Dengue is transmitted to a person by the bite of an *Aedes* mosquito that is carrying causal viruses.

Modes of transmission of communicable diseases

Air	Contaminated food and water	Direct or indirect contact	Insects
➤ Spreads flu, common cold, influenza, etc.	➤ Causes diarrhoea, typhoid, cholera, etc.	➤ Chicken pox, ringworm, common cold, etc.	➤ Causes malaria, dengue, plague, etc.

Prevention of communicable diseases

- Houses should be airy and open as fresh air and sunlight are natural disinfectants.
- Washing hands before eating prevent illness or spread of diseases.

- Germs of certain diseases stay on clothes, combs, towels and other articles used by a sick person. They should be properly cleaned and disinfected to kill the germs.
- Mosquitoes and their breeding grounds should be destroyed.

- Children suffering from any communicable disease should stay away from school till they are fully recovered.
- Drinking water should be boiled and kept covered to avoid infection. Water purifiers can also be used.
- Milk should be boiled at high temperature for at least half an hour and then cooled down quickly. This process is called **pasteurisation** which kills harmful bacteria.
- Food should be kept covered and stored properly by refrigeration or some other means to avoid growth of germs.
- Toilets and bathrooms must be cleaned and disinfected regularly.
- **Vaccination** is an effective way of preventing some communicable diseases. A **vaccine** produces immunity in the body to fight against the germs of the diseases. There are different vaccines for different diseases.

SELF TEST - 4

- Which of the following is a non-communicable disease?
 - Chicken pox
 - Beriberi
 - Common cold
 - Measles
- Which two diseases are caused by contaminated food and water?
 - Malaria and cholera
 - Diarrhoea and typhoid
 - Plague and chicken pox
 - Measles and flu
- Bunty is looking very weak and pale. He also gets tired easily. What do you think his diet is deficient in?

(A) Calcium	(B) Iodine
(C) Phosphorous	(D) Iron
- Mosquitoes and their larvae on stagnant water can be controlled by
 - Throwing garbage in the water
 - By putting oil on the surface of water
 - By growing plants in the water
 - All of these.
- Select the odd one out.
 - Obesity
 - Diabetes
 - Malaria
 - Heart disease

2.5 SAFETY AND FIRST AID

Accidents happen suddenly and can cause physical injuries. They usually happen when we are not careful. So, we must always be careful whether at home, at school or on the road. By being careful, we can avoid or lessen the impact of most accidents.

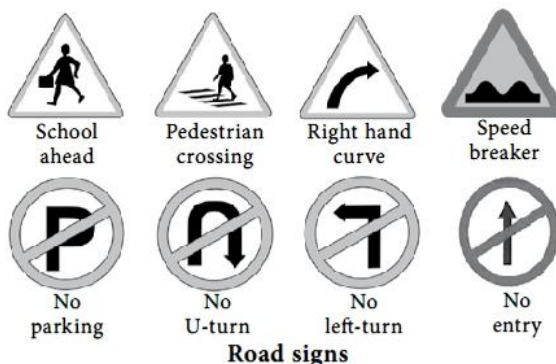
First aid is the first medical help given to an injured person before a doctor arrives.

The main aims of first aid are:

- to make sure the condition of the injured or sick person does not get worse.
- to relieve pain till the doctor arrives.
- to save lives.

Safety on Road

Safety on the road is more important nowadays because of the rapid increase in the number of vehicles. We should always read and follow roads signs carefully. They are meant for our safety.



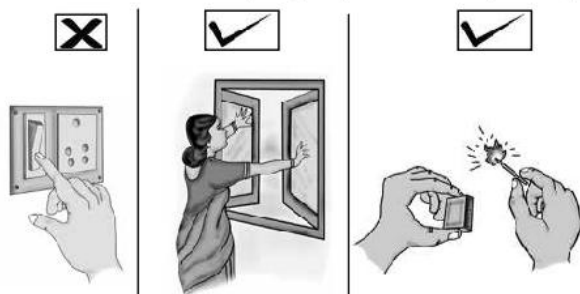
Safety from Fire

- Burning wood, plastic, cloth, etc., can be saved by pouring water. Water brings down the temperature and the fire is put out.
- Never use water if the fire is because of electric wires or



gadgets because electricity can flow through water and give an electric shock. These fires are put out by covering the burning object with sand or mud or using a fire extinguisher.

- Electrical appliances and wiring should be checked regularly for faults and breaks.
- In case of gas leak, all doors and windows should be opened. We should not switch on or off any electrical switch. We should not light a matchstick. We should call the gas agency immediately for help.



Safety measures during gas leak

- Fire caused by flammable liquids like kerosene, petrol etc can be extinguished by sand. Oil is lighter than water, so it floats on water and continues burning. Hence, water is not used to put out fire caused by oil.
- Synthetic clothes should not be worn while handling fire or while cooking.
- Small fires can be put out using fire extinguisher.
- In case of a major fire, the nearest fire station should be informed.
- If a person's clothes are on fire, he must not run. He/she should roll on the ground. He/she should be wrapped in a blanket to cut off air supply.



First Aid for Burn

Burns happen as a result of injury on skin from hot objects, fire, steam, firecrackers, electrical shocks and chemical reactions. Depending upon the severity of damage to the skin, burns can be minor or serious. Only minor burns can be treated at home, severe burns must be treated by the doctor.

Minor burns

Minor burns affect only the top layer of the skin. The skin becomes red and dry. The first aid given for minor burns is :

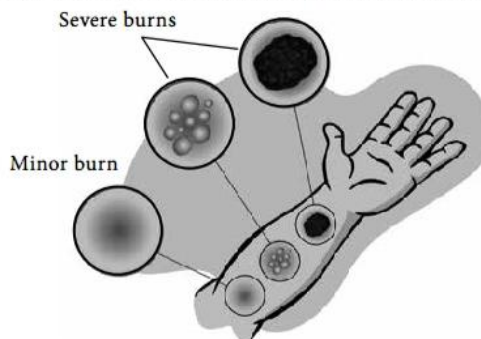


- Wash the burnt area with running cold water.
- An antiseptic cream or a paste of baking soda and water should be applied on the burn.

Severe burns

Severe burns affect top and underlying layers of the skin. The affected area becomes red and blisters form over it. The first aid given for severe burns is :

- Immerse the burnt part in cold water.
- Remove jewellery or clothes before blisters form.
- Never try to prick a blister.
- Dip a sterile piece of cloth in a solution of baking soda and use it as a wet compress. Go to the doctor.



Chemical burns

- Remove burn causing chemical by washing the affected part under cool, running water for at least 15 minutes.
- Remove clothing and jewellery that may be contaminated by the chemical.
- Cover the burn with sterile gauze and go to the doctor.

First Aid for Cuts, Wounds or Scratches

We should not neglect any wound, small or big. Germs can enter our body through these wounds and cause infection.

- Wash hands with soap and water before giving first aid to ourselves or others.
- Wash the wound with water and apply antiseptic.
- In case of bleeding, place a thick pad of cotton wool or sterile gauze on the wound to stop the bleeding.
- A tourniquet can be used to stop bleeding. Sometimes stitches are needed to help a wound heal.

- Tetanus injection must be taken if required.



Tourniquet to stop bleeding

First Aid for Nose Bleeds

- Make the patient sit down. Pinch the soft part of the nose and tilt the head slightly forward.
- Keep an ice pack or wet cloth on his/her nose and head.
- He/she should breathe through mouth for some time.
- Consult a doctor, if the bleeding is heavy.

First Aid for Sprains

Sprains are painful and sometimes cause swelling and redness. It occurs when a part of our body turns or gets twisted and swells up.



- We should apply ice pack on the sprained area till the swelling subsides.
- Wrap a crepe bandage around the twisted area to prevent unnecessary movement and give support to the joint.

First Aid for Animal Bites

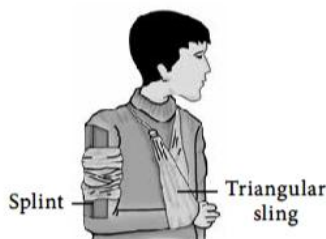
Animal bites can also be dangerous. Dogs, monkeys and cats can spread rabies.

- Consult a doctor immediately after washing the wound with soap and putting an antiseptic.
- When a poisonous snake bites, it puts the poison in the blood which can travel to the heart and nervous system and can cause death. So, a bandage should be tied tightly above the wound in such a way that the flow of blood to the heart is slowed down. Take the patient immediately to the doctor.

First Aid for Fracture

A crack or a break in a bone is called a **fracture**. We should keep the patient calm and comfortable. Before taking him to the doctor following first aid can be given.

- Keep a fractured body part steady. Place a padding to support fractured body part.
- If fracture is in the hand, make a **sling** made from the cloth to give support to the hand.
- Apply ice pack on the fractured area to reduce pain and control swelling.
- Take a magazine, a piece of cardboard or wood or pillow and tie it around the injured part. This will act as a **splint**. It will prevent movement of the bone.



SELF TEST - 5

- For putting out a fire caused by petrol, we should
 - Switch on the electric supply
 - Turn on the gas supply
 - Throw lots of sand on it
 - Throw water on it.
- The boy in the picture has a
 - Fracture
 - Sprain
 - Burn
 - Wound.
- Select the incorrect statement.
 - Never use water to extinguish fire if it is caused because of electric wires.



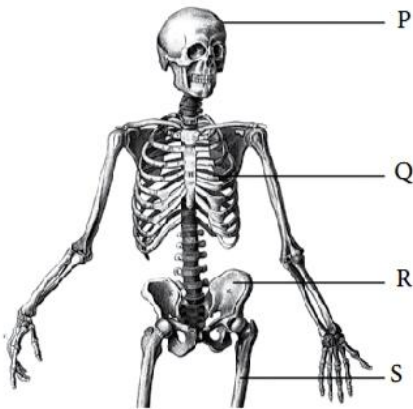
- Apply oil or butter on the burnt area of body.
 - Only minor burns should be treated at home, severe burns should be treated by the doctor.
 - None of these
- We should apply _____ on the sprained area till the swelling subsides.
 - Ice pack
 - Hot water bottle
 - Moisturiser
 - None of these
 - In case of gas leakage
 - Close all doors and windows
 - Plug on all the switches
 - Do not light matchstick
 - Both (A) and (C).

EXERCISE

1. An adult human has _____ bones and about _____ muscles present in the body.

- (A) 206, 600 (B) 600, 206
(C) 206, 425 (D) 300, 640

2. Identify the parts P, Q, R and S of human skeleton from the given figure.



- | P | Q | R | S |
|---------------------|-----------------|------------|-------------|
| (A) Skull | Backbone | Femur | Rib cage |
| (B) Shoulder girdle | Rib cage | Hip girdle | Skull |
| (C) Skull | Rib cage | Hip girdle | Femur |
| (D) Backbone | Shoulder girdle | Hip girdle | Breast bone |

3. Babli and Khushi are two friends. Babli is suffering from bleeding gums whereas Khushi cannot see properly in dim light. Select the option that correctly states changes both Babli and Khushi have to do in their diet in order to be fit and healthy.

- (A) Babli should include food rich in starch in her diet.
(B) Khushi must avoid eating green leafy vegetables in order to be fit.
(C) Babli should start eating citrus fruits in order to stay fit.
(D) Khushi should include food rich in calcium in her diet.

4. Refer to the given analogy and select the correct option.

Vitamin A : Papaya : Night blindness

- (A) Vitamin C : Cereals : Beriberi
(B) Vitamin D : Eggs : Rickets
(C) Calcium : Apples : Anaemia
(D) Iron : Iodized salt : Goitre

5. Read the given statements and select the option that correctly fills the blank in any two of them.

- (i) Backbone protects the _____.
(ii) Soft tissue inside the bone is called _____.
(iii) _____ muscles help in body movement.
(iv) _____ is an example of involuntary muscle.
(A) (i) Sternum, (iii) Skeletal
(B) (ii) Bone marrow, (iv) Skeletal muscles
(C) (i) Spinal cord, (ii) Bone marrow
(D) (iii) Cardiac, (iv) Smooth muscle

6. We should _____ to restore our energy and refresh our bodies.

- (A) Take rest (B) Do exercise
(C) Walk (D) Eat junk food

7. Match column I with column II and select the correct option from the given codes.

Column I	Column II
P. Pectoral girdle	(i) 22 bones
Q. Skull	(ii) 24 bones
R. Pelvic girdle	(iii) Shoulder
S. Rib cage	(iv) Hip

- (A) P-(iii), Q-(i), R-(iv), S-(ii)
(B) P-(iv), Q-(i), R-(iii), S-(ii)
(C) P-(iii), Q-(ii), R-(iv), S-(i)
(D) P-(iv), Q-(ii), R-(iii), S-(i)

8. Given below is a list of few diseases. How many of these are caused by bacteria?

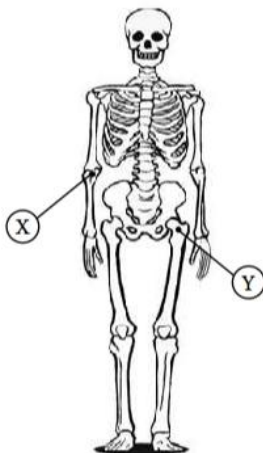
Polio, Dengue, Chicken pox, Measles, Flu, Plague, Typhoid, Ringworm, Malaria

- (A) 2 (B) 4
(C) 3 (D) 5

9. Ear ossicles are present in the

- (A) Inner ear (B) Outer ear
(C) Middle ear (D) Ear drum.

10. Refer to the given figure and select the correct statement regarding X and Y.



- (A) Joint X allows side to side movement.
 (B) Joint Y allows movement in all directions.
 (C) Joint X also occur between head and first vertebra of backbone in humans.
 (D) Joint Y also occur between bones of ankle.

11. Read the given statements and select the incorrect one.

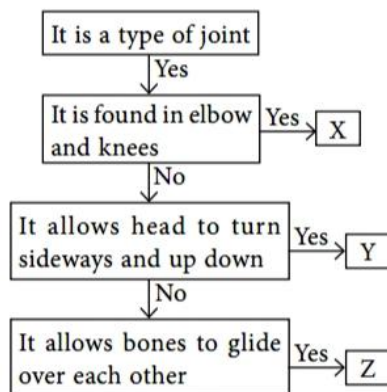
- (A) Skeletal system helps in body movement.
 (B) Backbone consists of 33 small bones called vertebrae.
 (C) Pelvic girdle connects upper limb to the body whereas pectoral girdle connects lower limb to the body.
 (D) Femur is the longest, strongest and largest bone of the body.

12. Refer to the given diagram of human eye and select the correct statement.



- (A) L helps to filter damaging ultraviolet radiations of the sunlight.
 (B) M can undergo a change in thickness to focus light on N.
 (C) N consists of a layer of light sensitive receptors.
 (D) All of these.

13. Refer to the given flow chart and select the correct option.



- | X | Y | Z |
|---------------------------|-----------------------|---------------|
| (A) Hinge joint | Pivot joint | Gliding joint |
| (B) Hinge joint | Ball and socket joint | Pivot joint |
| (C) Ball and socket joint | Hinge joint | Pivot joint |
| (D) Pivot joint | Gliding joint | Hinge joint |

14. Select the incorrect match.

- (A) Air : Influenza
 (B) Direct contact : Typhoid
 (C) Contaminated food and water : Cholera
 (D) Insect : Plague

15. Identify the part of brain 'X' from the given statements and select the correct statement regarding it.

- It controls hormone production
 - It controls body temperature
 - It controls emotion
- (A) X could be cerebellum that also helps to maintain balance.
 (B) X could be brain stem that also controls all involuntary functions.
 (C) X could be cerebrum that also controls memory and learning.
 (D) X could be diencephalon that also controls blood pressure.

Achievers Section (HOTS)

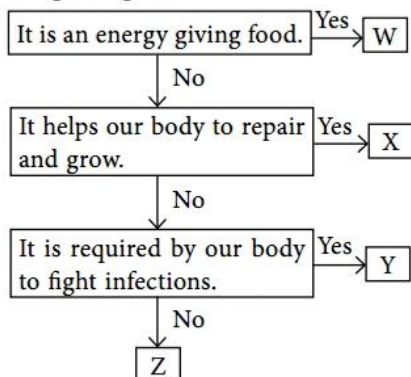
16. Study the given table and fill the blanks P, Q, R and S.

Deficiency disease	Deficient vitamin/mineral	Symptoms
Night blindness	P	Poor vision in darkness

Q	Iodine	Swelling in the neck
Anaemia	Iron	R
S	Vitamin C	Bleeding gums and wounds take longer time to heal.

- (A) P-Vitamin A Q-Beriberi
 (B) R-Weakness/ Tiredness S-Scurvy
 (C) P-Vitamin A R-Weak and soft bones
 (D) Q-Goitre S-Rickets

17. Refer to the given flow chart and select the correct statement regarding it.



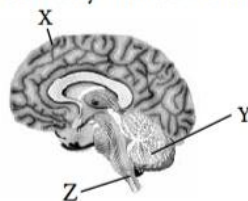
- (A) Potato is a source of W whereas butter is a source of X.
 (B) Green leafy vegetables are a source of both Y and Z.
 (C) Banana is a source of W and eating excess of Z can lead to constipation.
 (D) All of these

18. Select the option that correctly states the options as true (T) and false (F) ones.

- I. In case of burns, always remove the cloth stuck to the burnt part.
 II. Use an icepack in case of nose bleed.
 III. Sprain is an injury caused due to a crack or a break in bone.
 IV. Always wash fruits and vegetables before consuming to remove harmful chemicals on them.

- | | I | II | III | IV |
|-----|---|----|-----|----|
| (A) | F | T | F | T |
| (B) | F | T | F | F |
| (C) | T | T | T | F |
| (D) | T | T | F | T |

19. Identify X, Y and Z in the given figure and select the option that correctly mention their function.



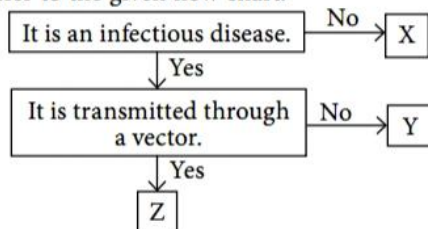
- | X | Y | Z |
|-----------------------------------|-------------------------------|-------------------------------|
| (A) Controls heartbeat | Maintains balance and posture | Controls learning ability |
| (B) Controls learning ability | Maintains balance and posture | Controls heartbeat |
| (C) Controls learning ability | Controls heartbeat | Maintains balance and posture |
| (D) Maintains balance and posture | Controls learning ability | Controls heartbeat |

20. Read the given statements. Correct the italicised words (wherever necessary) and select the incorrect option.

- (i) *Motor* nerves carry messages from sense organs to the brain and spinal cord whereas *sensory* nerves carry instructions from the brain and spinal cord to the muscles and organs.
 (ii) A *voluntary* and *immediate* action in response to a stimulus is called reflex action.
 (iii) Brain stem controls all *involuntary* functions.
 (iv) Spinal cord is a *thick* cord of nerves. It originates from *cerebellum*.
 (A) In statement (i), *motor* and *sensory* must be interchanged.
 (B) In statement (ii), *voluntary* must be changed to *involuntary* and *immediate* should not be changed as it is correctly mentioned.
 (C) In statement (iii), *involuntary* must be changed to *voluntary*.
 (D) In statement (iv), *thick* must not be changed whereas *cerebellum* must be changed to *medulla*.

SOF NSO 2018 QUESTIONS

1. Refer to the given flow chart.



Identify X, Y and Z and select the correct statement regarding them.

- (A) X could be anaemia whereas Z could be plague.
 (B) Y could be measles whereas Z could be scurvy.
 (C) X could be rickets whereas Y could be dengue.
 (D) Y could be malaria whereas Z could be cholera.

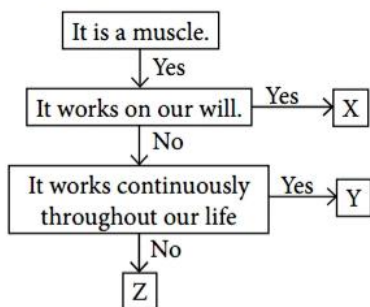
(Level-1)

2. Which part of brain will most likely affect our muscular coordination?

- (A) Cerebrum (B) Diencephalon
 (C) Medulla (D) Cerebellum

(Level-1)

3. Refer to the given flow chart and select the correct statement regarding X, Y and Z.



- (A) X appears smooth whereas Z appears striated.
 (B) Y pumps blood throughout the body.
 (C) X lines the internal wall of blood vessels.
 (D) None of these

(Level-1)

4. Two friends Shruti and Surbhi visited a general physician for their respective deficiency diseases. Doctor examined them and prepared a chart as given in the table to keep a record of their illness.

Name of the patient	Symptoms of disease	Preventive measures
Shruti	Pain in bone of arms and legs	Consumption of milk, milk products, fish and eggs
Surbhi	Difficulty in swallowing and breathing	Consumption of iodised salt and sea food

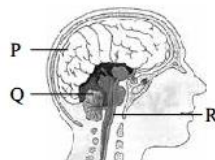
Study the given chart carefully and select the correct option regarding this.

- (A) Shruti is suffering from a disease which can spread from an infected person to a healthy person.
 (B) Surbhi is suffering from deficiency of a mineral that is required for formation of haemoglobin.
 (C) Shruti is suffering from a disease which can be eradicated by vaccination.

(D) Surbhi is suffering from mineral deficiency disease whereas Shruti is suffering from vitamin deficiency disease.

(Level-1)

5. Refer to the given figure.



Which of the given labelled parts is the centre of intelligence (X) and controlling involuntary actions of body (Y)?

- X Y
 (A) P R
 (B) R P
 (C) P Q
 (D) Q P

(Level-1)

6. Refer to the given table.

Deficiency disease	Vitamin/Mineral	Dietary suggestion
Scurvy	P	Citrus fruits
Q	Vitamin A	Green leafy vegetables
Goitre	R	Sea food

Select the option which correctly identifies P, Q and R.

- | | | |
|---------------|-----------------|-----------|
| P | Q | R |
| (A) Vitamin B | Rickets | Calcium |
| (B) Vitamin C | Night blindness | Iodine |
| (C) Calcium | Anaemia | Iron |
| (D) Iron | Marasmus | Vitamin D |

(Level-1)

7. Refer to the given relationship and select the option which correctly identifies X.

Hinge joint : Elbow :: Gliding joint : X

- (A) Wrist (B) Knee
 (C) Shoulder (D) Neck

(Level-1)

8. Priya categorised diseases on the basis of their pathogens and made three groups of three diseases each. By mistake, she put one wrong disease in each group. Identify the odd member and select the correct option.

Group I : Tuberculosis, Malaria, Tetanus

Group II : Dengue, Measles, Filariasis

Group III : Kala azar, Typhoid, Sleeping sickness

- (A) Malaria of group I should be interchanged with Typhoid of group III.
 (B) Filariasis of group II should be replaced with cholera.

- (C) Sleeping sickness of group III should be replaced with plague.
 (D) Tetanus of group I should be replaced with rhinitis. (Level-1)

9. Refer to the given figure of human brain.



Which of the following regulates blood pressure and flow in our body?

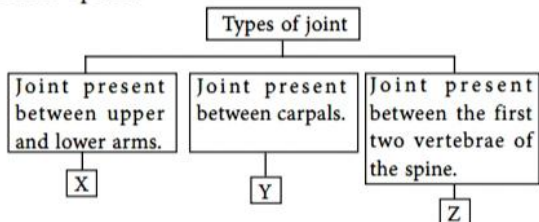
- (A) P (B) Q
 (C) R (D) S (Level-1)

10. Match column I (nutrient) with column II (function) and column III (deficiency symptom) and select the correct option from the given codes.

Column I	Column II	Column III
P. Vitamin C	(i) For normal functioning of thyroid glands	(a) Anaemia
Q. Iodine	(ii) Maintains normal vision	(b) Scurvy
R. Iron	(iii) Helps in keeping gums and joints healthy	(c) Goitre
S. Vitamin A	(iv) Required for haemoglobin formation	(d) Night blindness

- (A) P - (iii) - (b); Q - (i) - (c); R - (iv) - (a); S - (ii) - (d)
 (B) P - (ii) - (c); Q - (i) - (d); R - (iii) - (a); S - (iv) - (b)
 (C) P - (iv) - (a); Q - (ii) - (c); R - (i) - (b); S - (iii) - (d)
 (D) P - (i) - (b); Q - (iv) - (a); R - (iii) - (c); S - (ii) - (d)

11. Refer to the given classification table and select the correct option.



- (A) X could be hinge joint whereas Z could be pivot joint.
 (B) Y could be ball and socket joint whereas Z could be gliding joint.

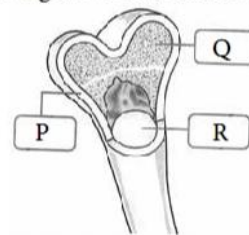
- (C) X could be gliding joint whereas Y could be pivot joint.
 (D) Y could be pivot joint whereas Z could be gliding joint. (Level-2)

12. Identify X, Y and Z from the given figure and select the correct statement regarding them.



- (A) Z is attached to bones whereas X is not attached to bones
 (B) Y is voluntary muscle whereas Z is involuntary muscle.
 (C) X is very strong muscle that works continuously.
 (D) None of these (Level-2)

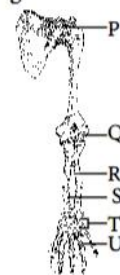
13. The given diagram shows section of a bone.



In which of the following parts new blood cells are produced?

- (A) P (B) Q
 (C) R (D) Both (P) and (R) (Level-2)

14. Which of the following statements are incorrect regarding the given figure?



- (i) The parts labelled P and Q show ball and socket joint and hinge joint, respectively.
 (ii) The part labelled R is radius bone.
 (iii) The parts labelled T and U are called metacarpals and carpals respectively.
 (iv) The part labelled S is ulna bone.
 (A) (ii) and (iii) only (B) (ii) and (iv) only
 (C) (i) only (D) (iii) only (Level-2)

HINTS & EXPLANATIONS

SELF TEST - 1

1. (C): Pivot joint is found between the first two vertebrae of the backbone.
2. (A): The skull of an adult human being contains 22 bones.
3. (A): The last 2 pairs of ribs are joined only to the back bone and remain free in the front of the ribcage, hence they are called floating ribs.
4. (A): Cardiac muscles are striated and involuntary in nature.
5. (C)

SELF TEST - 2

1. (D): An involuntary and immediate action in response to a stimulus is called reflex action. Reflex actions do not involve brain. They are controlled by spinal cord.
2. (C): The medulla controls all over involuntary activities such as heartbeat, breathing etc.
3. (A): Retina is the layer of light sensitive receptors at the back of the eye. Image is formed on the retina.
4. (D)
5. (D): Nerves are made of many nerve cells or neurons.

SELF TEST - 3

1. (C): Sugar is a source of carbohydrate and carbohydrates are known as energy giving nutrients. Soybean is a source of protein, orange is a source of vitamin C and spinach has iron.
2. (C): Rickets is caused due to deficiency of vitamin D.
3. (C): The fruit shown in the picture is guava and is rich in vitamin C.
4. (B)
5. (C): Roughage is the fibres present in the plant food, like vegetables, fruits and grains. Roughage adds bulk to the undigested food and helps the body to get rid of waste. Cabbage is a good source of roughage.

SELF TEST - 4

1. (B): Beriberi occurs due to the deficiency of vitamin B₁, hence it is a non-communicable disease, whereas chicken pox, common cold and measles are caused by virus and therefore are communicable diseases.

2. (B): Diarrhoea, typhoid and cholera spread by infected food and water. Malaria and plague are transmitted by insect bites. Flu spreads by air. Chicken pox and measles spread through direct contact.
3. (D): Bunty is most probably suffering from anaemia which occurs due to the deficiency of iron.
4. (B)
5. (C): Malaria is a communicable disease whereas obesity, diabetes and heart disease are non-communicable diseases.

SELF TEST - 5

1. (C)
2. (A): A crack or a break in a bone is called a fracture. The cloth tied around the neck gives support to the arm.
3. (B)
4. (A): Ice pack is applied on the sprained area to reduce the swelling.
5. (C)

EXERCISE

1. (A) 2. (C)
3. (C): Babli is suffering from scurvy that occurs due to deficiency of vitamin C, so she should take citrus fruits that are rich in vitamin C. Khushi is suffering from night blindness which occurs due to deficiency of vitamin A, so she should take fruits like papaya, mango etc that are rich in vitamin A.
4. (B): In the given analogy, papaya is a good source of vitamin A and the deficiency of vitamin A leads to night blindness. Similarly, eggs are good source of vitamin D and its deficiency results in rickets.
5. (C): Backbone is made up of 33 bones called vertebrae which forms vertebral column and protects the spinal cord. The soft tissue inside the bone is called bone marrow. Skeletal muscles help in body movements. Smooth cardiac muscles are examples of involuntary muscles.
6. (A)
7. (A)
8. (A): Plague and typhoid are caused by bacteria, polio, dengue, flu, chicken pox and measles are caused by virus. Malaria is caused by protozoa. Ringworm is caused by fungus.

9. (C) : Ear ossicles are a chain of three bones that transmit sound from the outer ear to the inner ear.
10. (B) : The joint present between hip girdle and femur is ball and socket joint. This type of joint allows movement in all directions.
11. (C) : Pectoral girdle provides connection between forelimbs with the skeleton and pelvic girdle attach hind limbs with the skeleton.
12. (D) : In the given diagram, L, M and N are cornea, lens and retina respectively.
13. (A) : In the given flow chart, X, Y and Z are hinge joint, pivot joint and gliding joint respectively.
14. (B) : Typhoid spreads through contaminated food and water.
15. (D)
16. (B) : In the given table, P is vitamin A, Q is goitre, R is weakness or tiredness and S is scurvy.
17. (B) : In the given flow chart, W could be carbohydrate or fat. X, Y and Z could be protein, vitamin/mineral and roughage respectively. Green leafy vegetables are a source of both vitamins/minerals and roughage.
18. (A) : In case of severe burns, we should not remove the cloth stuck to the burnt part. Sprain occurs when a part of our body turns or gets twisted and swells up.
19. (B) : In the given figure X, Y and Z are cerebrum, cerebellum and medulla respectively.
20. (C) : Brain stem includes medulla which connects the brain to the spinal cord. The medulla controls all our involuntary activities.

SOF NSO 2018 QUESTIONS

1. (A) : X could be a non-infectious disease such as anaemia, rickets, scurvy, etc. Y could be an infectious disease that is not transmitted through a vector, such as measles, cholera. Z could be an infectious disease that is transmitted through a vector, such as plague, dengue, malaria, etc.
2. (D) : Cerebrum is the centre of intelligence, it controls our thinking, learning, memory and senses. Diencephalon controls hormone production, behaviour, emotions, sleep, body temperature, eating, blood pressure and

consciousness. Medulla regulates heart beat and other involuntary functions.

3. (B) : In the given flow chart X, Y and Z represent skeletal muscle, cardiac muscle and smooth muscle respectively. Skeletal muscle appears striated whereas smooth muscle does not appear striated. Smooth muscle lines internal wall of blood vessels.
4. (D) : Shruti is suffering from vitamin D deficiency and it results in pain in bone of arms and legs. The doctor advised her to consume milk, milk products, fish and eggs, as all of these are good sources of vitamin D. Surbhi is suffering from iodine deficiency and it leads to difficulty in swallowing and breathing.
5. (A) : In the given figure, P, Q and R are cerebrum, cerebellum and medulla respectively. Cerebrum is the centre of intelligence and medulla controls all our involuntary actions.
6. (B) : Scurvy occurs due to the deficiency of vitamin C and the deficiency of vitamin A results into night blindness. Goitre occurs due to the deficiency of iodine.
7. (A) : In the given relationship, the joint present in elbow is hinge joint and gliding joint is present in wrist bones.
8. (A) : In group I, tuberculosis and tetanus are bacterial diseases but malaria is caused due to protozoa. In group II, dengue and measles are viral diseases while filariasis is caused by roundworm. In group III, kala azar and sleeping sickness are protozoan diseases while typhoid is a bacterial disease.
9. (C) : In the given figure, P is cerebrum, Q is cerebellum, R is medulla and S is pons. Medulla regulates blood pressure and blood flow in our body.
10. (A)
11. (A) : In the given classification table, X, Y and Z are hinge joint, gliding joint and pivot joint respectively.
12. (D) : In the given figure, X, Y and Z are skeletal muscle, smooth muscle and cardiac muscle respectively.
13. (C) : In the given diagram, P, Q and R are compact bone, spongy bone and bone marrow respectively.
14. (D) : The parts labelled T and U are called carpals and metacarpals, respectively.



Learning objectives

3.1 Parts of plants

3.4 Crops and agriculture

3.2 Reproduction in plants

3.3 Seed dispersal

Growing plants is very important for us as our life depends largely on them. Plants are essential for our survival. They provide us with many products and help us in different ways.

**Olympiad Bite**

On the surface of the leaves, tiny holes called stomata are present. It is through these stomata that air enters and exits from leaves.

3.1 PARTS OF PLANTS

Plants are made up of different parts, *i.e.*, roots, stem, leaves, flowers and fruits.

Flower

It is the most colourful and attractive part of a plant. It attracts birds, insects, etc., and helps in reproduction. Flowers of plants like cauliflower, broccoli, etc., can be eaten.

Stem

Stem is the part of a plant that grows above the ground. It bears leaves, branches, flowers and fruits. It helps to carry water and minerals from roots to different plant parts and prepared food from leaves to different plant parts. It also store food, *e.g.*, stems of potato, ginger, sugarcane, etc., are modified to store food.

Leaf

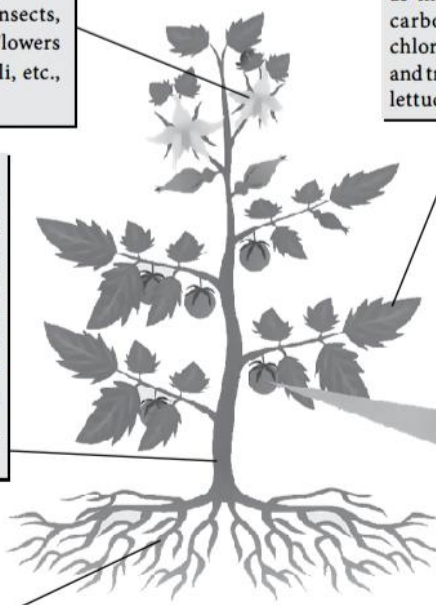
Leaves are known as the **kitchen of the plant** as they prepare food with the help of water and carbon dioxide in the presence of sunlight and chlorophyll. Leaves take part in exchange of gases and transpiration. They also store food, *e.g.*, spinach, lettuce, cabbage, etc.

Seeds

Seeds are present inside fruits. A plant can have one seed or many seeds. New plants grow from them. We get dry fruits, oil, spices, cereals and pulses from seeds.

Fruit

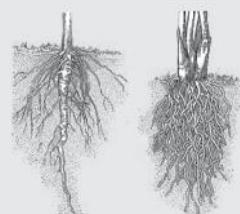
It is formed from flowers. We eat fruits of plants, *e.g.*, mango, watermelon, papaya, etc.

**Root**

It is the part of a plant that grows below the ground. It helps the plant to hold firmly to the soil, absorb water and minerals from soil and helps to store food, *e.g.*, carrot, radish, turnip, etc. Roots are of two types – tap roots and fibrous roots.

Tap root : It comprises of one main root and many small roots growing sideways from it, *e.g.*, beans, carrot, pea, etc.

Fibrous root : It comprises of a bushy bunch of roots which grow from the end of the stem, *e.g.*, grass, rice, onion, etc.



Tap root

Fibrous root

SELF TEST - 1

- _____ make food for the plant.
(A) Root (B) Leaves
(C) Fruit (D) Seed
- Part of the plant that generally grows below the ground is called _____.
(A) Stem (B) Root
(C) Seed (D) Flower
-  (onion) is a
(A) Root (B) Stem
(C) Flower (D) Leaf
- Select the incorrect statement.
(A) Roots of a plant help to absorb water and minerals from soil.
(B) Seeds give rise to new plants.
(C) We eat flower of broccoli plant.
(D) None of these
- Select the odd one out.
(A) Radish (B) Onion
(C) Ginger (D) Potato

3.2 REPRODUCTION IN PLANTS

New plants grow from seeds, spores or other plant parts like stem, root or leaves. This process of production of new plants is called **reproduction**.

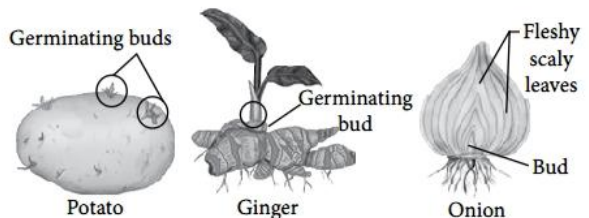
Though plants may reproduce by stem (e.g., sugarcane, potato, ginger and rose), root (e.g., sweet potato), leaf (e.g., *Bryophyllum* and *Begonia*) or by spores (e.g., ferns), reproduction by seeds is seen among most of the flowering plants.

Vegetative Reproduction in Plants

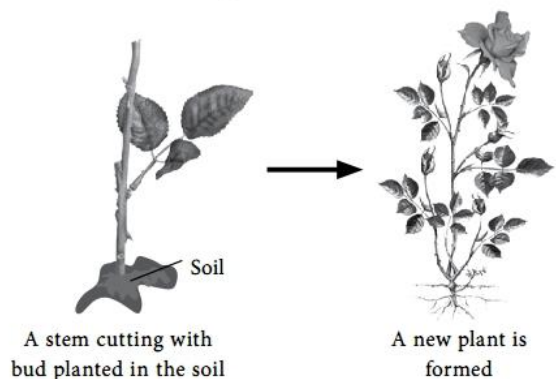
Vegetative reproduction refers to production of new plants through its vegetative parts like roots, stem and leaves.

Reproduction by stem

Stems serve as propagating structures in some plants. In some plants stems become underground and get modified to store food. When the main plant dies on the arrival of unfavourable conditions, these underground structures help to tide over the unfavourable season. On arrival of favourable season the buds present on these stems give rise to a new plant. As these stems store food, they can be consumed. For example small buds (eyes) on potato and ginger give rise to a new plant. Buds of onion and garlic, present inside the bulb, give rise to a new plant. Plants like strawberry, carpet grass, etc., grow from long stems that grow underground. Stems of some plants can be artificially induced to produce new plants. In this method, a stem cutting is taken from the mother plant and its lower end is buried in moist soil. After a few days, the cutting develops roots, branches and grows into a new plant, e.g., rose, *Hibiscus*, etc.



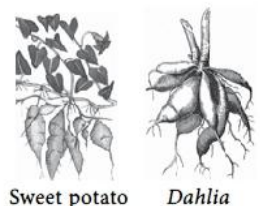
Plants that grow from stems



Stem cutting of rose plant

Reproduction by roots

In some plants, roots get modified to store food and give rise to new plants. Plants like sweet potato, *Dahlia*, carrot, radish, beetroot, etc., give rise to new plants from their roots.



Reproduction by roots

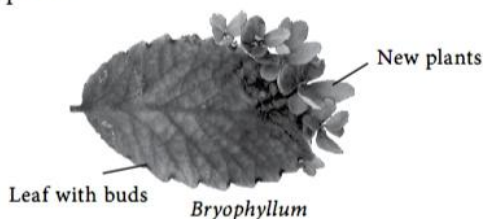


Olympiad Bite

A bud represents a short stem around which immature overlapping leaves are folded. Vegetative buds can give rise to new plants.

Reproduction from leaves

Plants like *Bryophyllum* reproduce through their leaves. The leaves have many small buds in their marginal notches that grow along their edges and give rise to new plants.



Reproduction by leaves

Reproduction from Spores

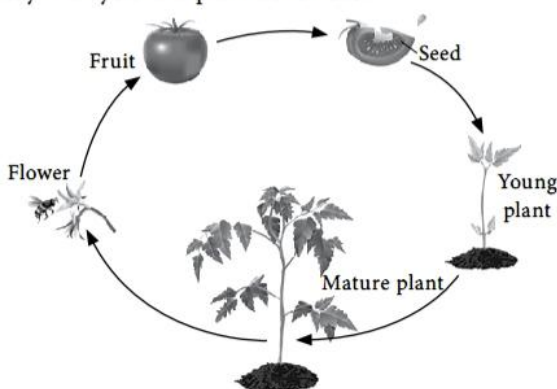
Non-flowering plants like ferns and mosses reproduce through spores (special structures present on the leaf).



Fern leaf

Reproduction from Seeds

Most of the plants grow from seeds. A seed grows into a new plant only when it gets appropriate air, water, soil and temperature. A seed germinates to produce a baby plant or a seedling. When this baby plant becomes an adult, it again bears flowers, produces fruits and seeds. These seeds again germinate into new plants. In this way life cycle of a plant continues.

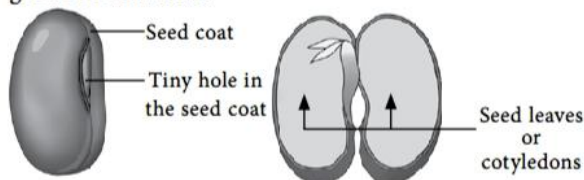


Life cycle of a plant

Parts of a seed

A seed is hard and dry. We can say it's a dehydrated propagule. Its outer covering is called the **seed coat**. It protects the baby plant inside the seed. The seed coat has a tiny hole through which the seed absorbs water. One or two seed leaves or **cotyledons** are present inside

the seed coat, which have food stored in them. A baby plant or embryo is also seen between the cotyledons. The baby plant uses food from the cotyledons till it grows its own leaves. When conditions are favourable, the baby plant forms a seedling. The baby shoot grows upwards to form stem and leaves whereas baby root grows downwards.



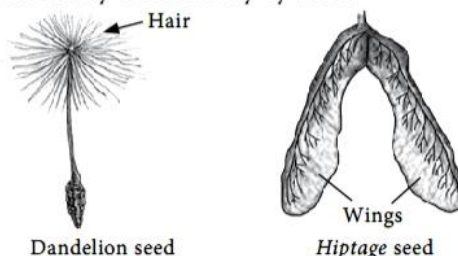
Structure of seed

Some seeds have only one cotyledon. Such plants are called **monocots**, e.g., rice, wheat, etc. Some seeds have two cotyledons. Such plants are called **dicots**, e.g., bean, pea, etc.

3.3 SEED DISPERSAL

The process by which the seeds are scattered away from the parent plant is called **dispersal**. Seeds need warmth of sunlight, water and space to grow. If all baby plants grow near the parent plant, not all would survive as they will not get enough space to grow. Hence, agents are needed to carry the seeds or fruits away from the parent plant. Dispersal is carried out by wind, water, animals and by explosion of fruits.

Dispersal by wind : Seeds dispersed by wind are usually light and have wings or hair on them. These seeds are easily carried away by wind.



Seeds dispersed by air

Dispersal by water : Plants growing in and near water have fruits and seeds that can float in water. Lotus fruit has a spongy and porous part which helps it in floating. Coconut has a thick fibrous coat helping it to float away to far off places and also to protect it from getting wet.



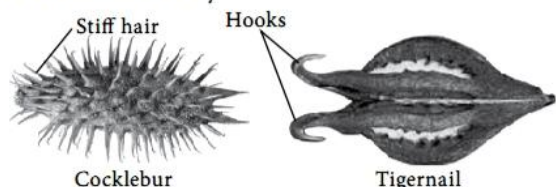
Coconut



Lotus

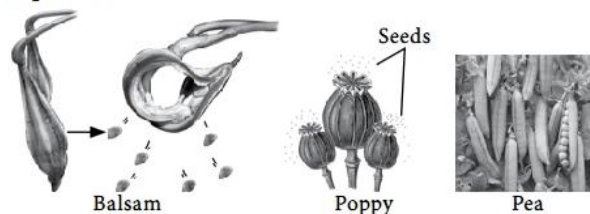
Seeds dispersed by water

Dispersal by animals and human beings : Animals and human beings eat some fruits and throw away the seeds, which grow into new plants. Birds swallow some seeds which come out unchanged in their droppings and grow into new plants. Some seeds have hooks or spines which get stuck to the hairy skin of animals and are carried away.



Seeds dispersed by animals

Dispersal by explosion : Fruits of certain plants such as balsam, poppy, pea and bean burst open when they are ripe and dry. Seeds get scattered in all directions. This mechanism of seed dispersal is called explosion.

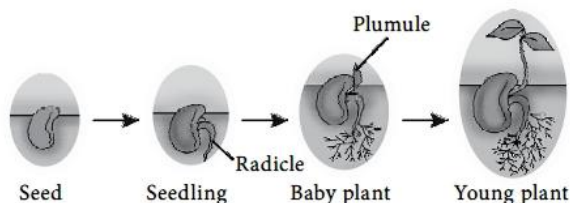


Seeds dispersed by explosion

Germination of Seed

Germination is the process by which a seed grows into a seedling. Air, water and warmth are needed for germination.

- A seed needs oxygen to obtain energy from cotyledons.
 - It needs water to soften the seed coat so that baby plant can come out easily and change the stored food in the cotyledons into a soluble form so the embryo can use it.
 - Warmth of sunlight is essential for its growth.
- The seed becomes active. It starts growing downwards as a tiny root or radicle.

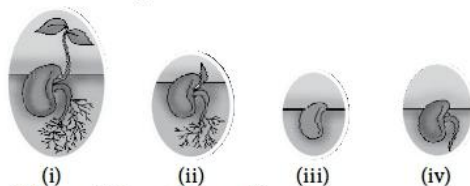


Stages in germination of a seed

Then a tiny shoot or plumule grows upwards. The radicle forms the root system and the plumule forms the shoot system of the adult plant. As the plant grows in size, the cotyledons shrink and disappear. The seedling grows to become a young plant.

SELF TEST - 2

1. Select the odd one out.
(A) Rose (B) *Hibiscus*
(C) Sweet potato (D) *Bougainvillea*
2. Refer to the given figures (i-iv) and arrange them in the correct sequence.



- (A) (iii) → (iv) → (ii) → (i)
- (B) (iv) → (iii) → (ii) → (i)
- (C) (i) → (ii) → (iii) → (iv)

- (D) (iii) → (ii) → (iv) → (i)
3. Seeds of plant 'X' are light and have wings or hair on them. Plant 'X' could be
(A) *Urena* (B) Lotus
(C) Cocklebur (D) *Hiptage*.
4. Select the option in which two monocot seeds are placed.
(A) Gram and pea (B) Pea and bean
(C) Bean and wheat (D) Wheat and rice
5. Which of the following are needed by a seed to germinate?
(A) Air (B) Water
(C) Warmth (D) All of these

3.4 CROPS AND AGRICULTURE

Plants are grown on a large scale to feed the entire population of a country. This practice of growing plants on a large scale is called **agriculture**. The plants of one kind that are grown in large quantities in a particular area or region during a particular period

are called **crops**. Different types of crops are:

- Food grain crops (wheat, rice, maize, etc.),
- Vegetable and fruit crops (sugarcane, apple, orange, onion, etc.)
- Oil producing crops (mustard, sunflower, etc.)

- Fibre crops (jute, cotton, etc.)
- Plantation crops (tea, coffee, etc.)

Different crops are grown in different seasons.

Rabi crops : The crops which grow in winter season (November to April) are known as **rabi crops**. For example, wheat, mustard, gram, etc. Rabi in Arabic means 'spring'. These crops are usually harvested in spring.

Kharif crops : The crops which are sown with the arrival of monsoon and are grown in monsoon season (June to October) are known as **kharif crops**. For example, rice, soyabean, groundnut, maize, etc. Kharif in Arabic means 'autumn'. These crops are usually harvested in autumn.

Stages of Agriculture

The various stages of agriculture are as follows :

Ploughing : Before the seeds are planted, the soil over the entire field has to be loosened. This is called **ploughing** and is done manually by a plough or by using a tractor.



Ploughing

Adding manure and fertilisers : It is done to increase the fertility of the soil. Manures, like cow dung, etc., or chemical fertilisers like superphosphate and urea are added to the soil to make it rich in minerals. It is safer to use manure instead of chemical fertilisers.



Adding manure

Sowing : Only healthy seeds are selected to be sown to grow healthy plants. Seeds are to be spaced properly while sowing and they should not be sown too deep in the soil. Sowing can be done by hands or by using a seed drill.



Sowing

Irrigation : When seeds germinate and new plants start growing, the fields have to be irrigated properly. Proper irrigation means the right amount of water at the right time. Water for irrigation can be delivered to the field by irrigation canals, tubewells or pumps operated by electricity, petrol, diesel, etc.



Irrigation



Olympiad Bite

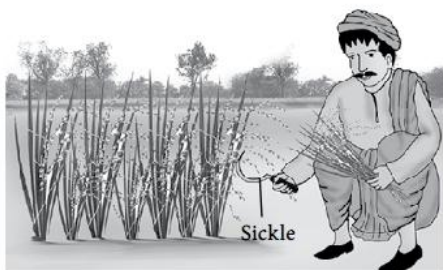
Modern methods of irrigation involve sprinkler system and drip irrigation. Drip technique has been developed keeping in mind the shortage of water resources in some places. This system consists of pipes and tubes which supply water to the plants drop by drop, thus minimise wastage.

Protecting the crops : Crops have to be protected from grazing animals by fencing or some other means. Insecticides and pesticides are sprayed to protect the crops from insects like locusts, caterpillars, grasshoppers, etc. and pests like rats, moles, etc. It is better to use pesticides and insecticides made from plants such as neem rather than using chemical ones. Weeds that grow with the main crop should be pulled out from the field as they compete with the main crop for nutrients. Farmers also use scarecrows in their fields to protect crops from birds.



Spraying pesticide

Harvesting : As the crops mature, they are ready to be cut down. This is called **harvesting**. A particular part of the plant like fruits (e.g., apple), entire plant (e.g., sugarcane), flowers (e.g., jasmine), seeds and stem (e.g., rice, wheat, etc.) or roots (e.g., sweet potato) are harvested. Harvesting is done by hand or by using sickle or by using a machine called **harvester**.



Harvesting

Threshing and winnowing : After crops are collected, grains are separated from the stalks by beating the stems against a hard surface called threshing. This is also done by a machine called **thresher**.



Threshing



Winnowing

The separation of grains from the chaff is called winnowing. It is done by letting grains fall against the breeze. This forms two clear separate heaps, one consists of the grain and the other consists of the chaff.

Storing : Flowers, fruits and vegetables cannot be stored for long and they have to be quickly transported to the market. Cereals and pulses can be stored if they are stored in dry and clean containers.



A sack of wheat grains



Storage containers for grains

Most of the grains are used as food and some are kept as seeds to be planted for the next season. But these grains should be again protected from insects and pests. For this, they are sometimes fumigated and stored in silos or jute bags or metallic bins.

SELF TEST - 3

1. Select the odd one out on the basis of type of crops.

- (A) Mustard (B) Maize
(C) Gram (D) Pea

2. Select the incorrect statement.

- (A) Seeds should be sown very deep in the soil.
(B) When seeds start germinating and change into seedling the field needs to be watered properly.
(C) Weeds are unwanted plants that compete with the main crops for nutrients.
(D) Superphosphate is a chemical fertiliser that helps to enrich the soil in nutrients.

3. Separating the grain from the chaff can be done by

- (A) Ploughing (B) Sowing
(C) Winnowing (D) Threshing.

4. Refer to the given figure.



Which of the following agricultural practices is being done by the person?

- (A) Threshing (B) Harvesting
(C) Irrigation (D) Ploughing

5. Which of the following is used to store grains?

- (A) Jute bags (B) Silos
(C) Metallic bins (D) All of these

EXERCISE

1. Refer to the plant shown in the picture and select the correct statement regarding it.

- (A) Seeds of this plant are dispersed by animals.
- (B) Seeds of this plant are dispersed by water.
- (C) Seeds of this plant are dispersed by wind.
- (D) Seeds of this plant are dispersed by explosion.



2. Select the option that correctly identifies the seed shown in the figure and its mode of dispersal.

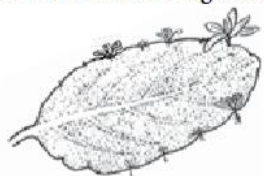
- (A) Spear grass : Animal
- (B) Cotton : Wind
- (C) Cocklebur : Animal
- (D) Balsam : Water



3. During the process of seed germination, the part that develops first is

- (A) Root
- (B) Shoot
- (C) Both root and shoot
- (D) Sometimes root and sometimes shoot.

4. Identify the plant whose leaf is shown in the picture and select the correct statement regarding it.

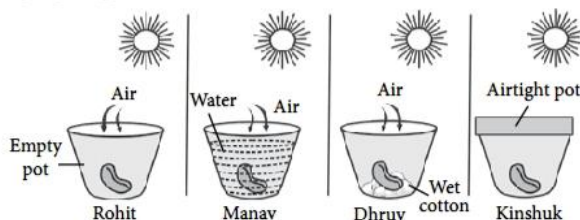


- (A) The leaf shown is of *Bryophyllum* and it helps in vegetative propagation.
- (B) The leaf shown is of lotus which propagates vegetatively by roots.
- (C) The leaf shown is of rose, which propagates vegetatively by stem.
- (D) The leaf shown is of pea plant which propagates vegetatively by fruit.

5. Spores are usually produced by

- (A) Flowering plants only
- (B) Non-flowering plants
- (C) Both flowering and non-flowering plants
- (D) Non-green plants only.

6. Four friends Rohit, Manav, Dhruv and Kinshuk are trying to germinate a bean seed as follows :



Whose seed will germinate?

- (A) Rohit's
- (B) Manav's
- (C) Dhruv's
- (D) Kinshuk's

7. Which stage of agriculture is called harvesting?

- (A) When growing plants are watered
- (B) When mature crop is cut down
- (C) When pesticides are sprayed
- (D) When seeds start germinating

8. Leaves of which of the following plants can be used to make insecticide at home?

- (A) Mango
- (B) Coconut
- (C) Peepal
- (D) Neem

9. Select the option in which one rabi and one kharif crop is paired correctly.

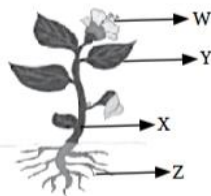
- (A) Gram : Mustard
- (B) Wheat : Soybean
- (C) Rice : Maize
- (D) Soyabean : Groundnut

10. Read the given statements and select the incorrect ones.

- (i) New plants can grow only from seeds.
- (ii) The cotyledons store food that is used by growing plant.
- (iii) Seeds can germinate without water.
- (iv) Kharif crops are grown in summer.

- (A) (i) and (ii) only
- (B) (i) and (iii) only
- (C) (i), (ii) and (iii) only
- (D) (i), (iii) and (iv) only

11. Refer to the given figure and select the option that correctly lists the plant in which the labelled part is edible.



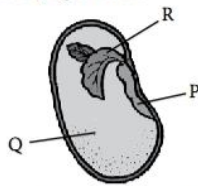
- (A) W - Cauliflower, Broccoli
 (B) X - Radish, Sugarcane
 (C) Y - Cabbage, Carrot
 (D) Z - Turnip, Ginger

12. Name of some of the plants are given below. How many of these are dispersed by wind ?

Pea, *Hiptage*, Lotus, Mango, Apple, Balsam, *Geranium*, Madar, Coconut, Dandelion

- (A) 3 (B) 4
 (C) 5 (D) 6

13. Refer to the given figure and select the option that correctly identifies P, Q and R.



- | P | Q | R |
|-------------|-----------|-----------|
| (A) Plumule | Seedcoat | Radicle |
| (B) Plumule | Cotyledon | Radicle |
| (C) Radicle | Cotyledon | Plumule |
| (D) Radicle | Plumule | Cotyledon |

14. Select the odd one out on the basis of number of cotyledons present in their seeds.

- (A) Rice (B) Corn
 (C) Wheat (D) Pea

15. How do seed X and seed Y get dispersed?



- | X | Y | X | Y |
|-----------|-------|---------------|-------|
| (A) Wind | Water | (B) Explosion | Water |
| (C) Water | Wind | (D) Explosion | Wind |

Achievers Section (HOTS)

16. Refer to the given table.

Plant	Vegetative propagule		
	Stem	Root	Leaf
P	—	✓	—
Q	—	—	✓
R	✓	—	—

Which of the following options correctly identifies plants P, Q and R?

- | P | Q | R |
|-------------------|----------------------|--------------|
| (A) Broccoli | <i>Bougainvillea</i> | Sweet potato |
| (B) <i>Dahlia</i> | <i>Begonia</i> | Ginger |
| (C) Potato | <i>Bryophyllum</i> | Carrot |
| (D) Turnip | <i>Hibiscus</i> | Radish |

17. Tanu made three groups consisting of three plants each wherein she classified plants on the basis of their vegetative propagules. She placed one wrong plant in each group. Identify the wrong plant and select the correct option.

Group I : Ginger, Onion, *Dahlia*

Group II : Turnip, Potato, Radish

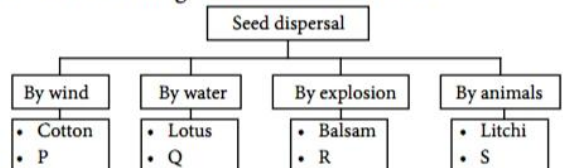
Group III : *Bryophyllum*, Carrot, *Begonia*

- (A) Ginger of group I should be interchanged with carrot of group III
 (B) *Dahlia* of group I should be interchanged potato of group II.
 (C) Carrot of group III should be replaced with *Bougainvillea*.
 (D) Onion of group I should be interchanged with carrot of group III.

18. Match column I with column II and select the correct option.

- | | |
|------------------|-----------------------|
| (i) Cotyledon | (p) Wheat |
| (ii) Ploughing | (q) Seed leaves |
| (iii) Rabi crop | (r) Baby shoot |
| (iv) Kharif crop | (s) Loosening soil |
| (v) Plumule | (t) Collecting grains |
| (vi) Threshing | (u) Maize |
- (A) (i) - q, (ii) - p, (iii) - s, (iv) - t, (v) - r, (vi) - u
 (B) (i) - q, (ii) - s, (iii) - p, (iv) - u, (v) - r, (vi) - t
 (C) (i) - r, (ii) - s, (iii) - u, (iv) - p, (v) - q, (vi) - t
 (D) (i) - r, (ii) - t, (iii) - p, (iv) - u, (v) - q, (vi) - s

19. Refer to the given classification chart.



Select the option that correctly identifies P, Q, R and S.

- | P | Q | R | S |
|---------------|-----------------|--------------|------------|
| (A) Madar | Bean | <i>Urena</i> | Apple |
| (B) Apple | <i>Geranium</i> | Mango | Banana |
| (C) Dandelion | Coconut | Poppy | Watermelon |
| (D) Cocklebur | China rose | Pea | Mango |

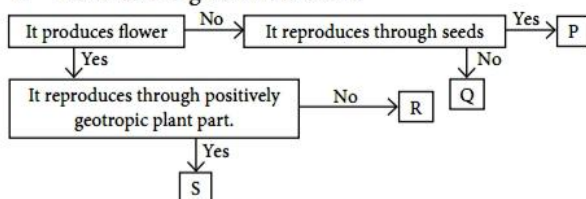
20. Read the given statements and select the option that correctly identifies them as true (T) and false (F) ones

- Leaves of plants help in gaseous exchange.
- Crops grown in winter are called kharif crops whereas crops grown in summer are called rabi crops.
- Seeds of conifers are naked and not enclosed within the fruit.
- Seeds of *Xanthium* and dandelion are dispersed by wind and by animal respectively.

(i)	(ii)	(iii)	(iv)
(A) T	F	T	F
(B) F	F	T	T
(C) T	T	F	F
(D) F	T	F	F

SOF NSO 2018 QUESTIONS

1. Refer to the given flow chart.

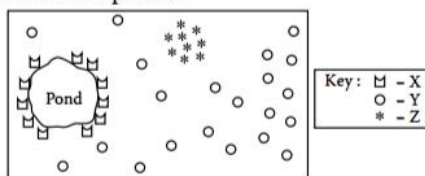


Select the option which correctly identifies P-S.

P	Q	R	S
(A) Mango tree	Fern	Potato	<i>Bryophyllum</i>
(B) Maize	Onion	Strawberry	Sweet potato
(C) Pine tree	Moss	Ginger	<i>Dahlia</i>
(D) Wheat	Banana	Rose	<i>Bougainvillea</i>

(Level-1)

2. Refer to the given picture representing seed dispersal of three different plants.

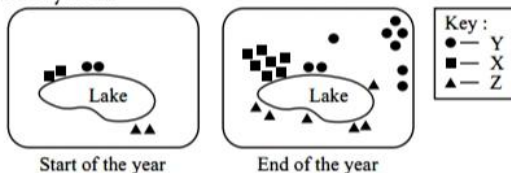


Which of the following could be Z?

- Balsam
- Dandelion
- Hiptage*
- Coconut

(Level-1)

3. The given figures show a plot of land at two different times of years.

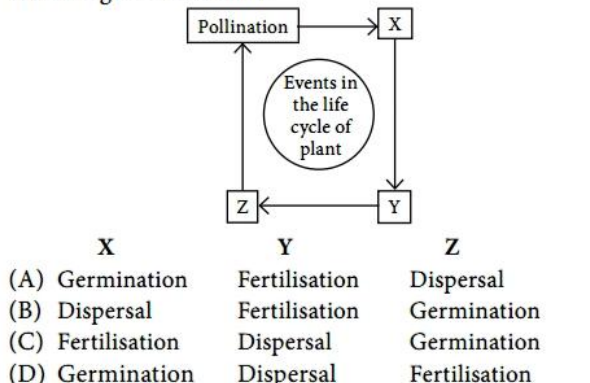


Which of the following could be pea and maple respectively?

Pea	Maple
(A) Z	X
(B) X	Z
(C) Y	Z
(D) X	Y

(Level-1)

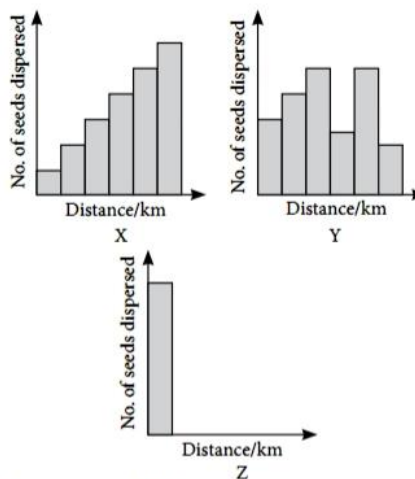
4. Select the option which correctly identifies X, Y and Z in the given flow chart.



X	Y	Z
(A) Germination	Fertilisation	Dispersal
(B) Dispersal	Fertilisation	Germination
(C) Fertilisation	Dispersal	Germination
(D) Germination	Dispersal	Fertilisation

(Level-1)

5. Three different types of plants X, Y and Z were selected by Pratima who wanted to document their methods of seed dispersal. The graphs below show the approximate number of seedlings found at various distances from the parent plant.

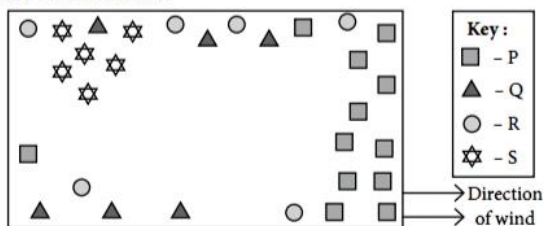


Select the option which correctly identifies X, Y and Z plants.

X	Y	Z
(A) Coconut, Lotus	Balsam, <i>Urena</i>	Castor, Cherry
(B) <i>Hiptage</i> , <i>Acer</i>	<i>Xanthium</i> , <i>Urena</i>	Balsam, Pea
(C) <i>Acer</i> , <i>Urena</i>	Balsam, <i>Xanthium</i>	Pea, Castor
(D) Drumstick, Coconut	<i>Xanthium</i> , <i>Acer</i>	Pea, Lotus

(Level-1)

6. Four different plants (P, Q, R and S) were planted in a field. The given figure shows distribution of the plants after two months.



Which of the following is most likely to be pea plant?

- (A) P (B) Q
(C) R (D) S (Level-1)

7. Select the plant pair that uses the similar kind of propagule for natural vegetative reproduction.

- (A) *Bryophyllum* and *Bougainvillea*
(B) *Eichhornia* and Strawberry
(C) Ginger and Turnip
(D) *Begonia* and Radish (Level-1)

8. On the basis of seed dispersal, Manisha made four groups of three plants each. In an attempt of doing so, she classified plants incorrectly in one of the groups. Identify this group and select the correct option.

- (A) Apple, Papaya, Peach
(B) Madar, Dandelion, *Hiptage*
(C) Coconut, Lotus, Water lily
(D) Castor, Balsam, *Xanthium* (Level-1)

9. Select the option that is not true regarding the type of seed dispersal shown in the figure.



- (A) Seeds dispersed by this method are small and light in weight.
(B) This type of seed dispersal is found in cotton and dandelion.

- (C) Seeds dispersed by this method may possess hair or wing like structures.
(D) This type of seed dispersal cannot carry the seeds to far off places.

(Level-2)

10. Which of the following statements is not true?

- (A) Potato is an underground stem.
(B) Edible part of sweet potato is root.
(C) Seeds of *Xanthium* are dispersed by explosion.
(D) Seeds with two cotyledons are called dicot seeds.

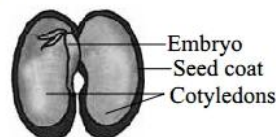
(Level-2)

11. Which of the following reproduce(s) in the same way as the ginger plant?



- (A) Y only (B) X and Z only
(C) Y and Z only (D) X, Y and Z (Level-2)

12. The given type of seed may belong to which of the following plants?



- (A) Maize and onion (B) Peas and beans
(C) Gram and maize (D) Wheat and rice (Level-2)

13. Seema grouped plants on the basis of their mode of vegetative reproduction. In one of the groups she placed an incorrect member by mistake. Identify this group and select the correct option.

- (A) Potato, Ginger, Onion
(B) Sweet potato, *Dahlia*, Carrot
(C) *Bryophyllum*, *Begonia*, Sugarcane
(D) *Hibiscus*, *Bougainvillea*, Rose (Level-2)

HINTS & EXPLANATIONS

SELF TEST - 1

1. (B) : Leaves are known as the kitchen of the plant as they prepare food for the plant.
2. (B) : Roots of plants generally grow below the ground, while stem, seed and flower are parts of the shoot system. They grow above the ground.
3. (B)
4. (D)
5. (A) : Onion, potato and ginger are modified stems while radish is modified root.

SELF TEST - 2

1. (C) : Sweet potato reproduces from root whereas *Hibiscus*, rose and *Bougainvillea* reproduce from stem.
2. (A)
3. (D) : The seeds of *Hiptage* have wings attached to them which help them float in air to long distances.
4. (D) : Some seeds have only one cotyledon and such plants are called monocots. Wheat and rice are monocots.
5. (D)

SELF TEST - 3

1. (B) : Mustard, gram and pea are rabi crops whereas maize is a kharif crop.
2. (A) : Seeds should not be sown too deep in the soil as it will not get proper nutrients to grow.
3. (C)
4. (B) : The man in the given figure is harvesting the crops using a sickle
5. (D)

EXERCISE

1. (B) : The plant shown in the picture is coconut tree. Its seeds are dispersed by water.
2. (C) : The seed shown in the picture is *Xanthium* or cocklebur. It is covered with stiff, hooked spines which help it stick to the fur of animal which carry it to long distances.
3. (A)
4. (A) : In *Bryophyllum*, leaves have buds in their marginal notches. When these leaves detach from plant come in contact with moist soil their buds give rise to new plant.

5. (B) : Spores are propagules of non-flowering plants like ferns and mosses.
6. (C) : In Rohit's set up seed is getting air and sunlight but no moisture so it will not germinate. In Manav's set up seed is getting air, excess water and sunlight but it will not germinate in presence of excess water. In Dhruv's set up seed is getting adequate moisture, sunlight and air so it will germinate. In Kinshuk's set up seed is not getting air, water or sunlight so it will not germinate.
7. (B)
8. (D)
9. (B) : Gram and mustard are rabi crops. Rice and maize are kharif crops. Soyabean and groundnut are kharif crops. Option (C) is the correct answer which pairs one rabi crop (wheat) and one kharif crop (soybean).
10. (B) : Plants can grow from seeds as well as from vegetative parts like stem, roots and leaves. Seeds need moisture to germinate.
11. (A) : In the given figure, W is flower, X is stem, Y is leaf and Z is root. Flowers (W) of cauliflower and broccoli are edible. Stem (X) is edible in sugarcane and ginger. Root (Z) is edible in radish, carrot and turnip. Leaf (Y) is edible in cabbage.
12. (A) : *Hiptage* Madar and Dandelion seeds are dispersed by wind. Pea, Balsam and *Geranium* seeds are dispersed by explosion. Lotus and coconut seeds are dispersed by water whereas mango and apple seeds are dispersed by animals.
13. (C) : In the given figure, P is radicle Q is cotyledon and R is plumule.
14. (D) : Rice, wheat and corn are monocots and have single cotyledon in their seeds whereas pea is a dicot and has two cotyledons in its seed.
15. (D) : Seeds X and Y are of pea and *Hiptage*. They get dispersed by explosion and by air respectively.
16. (B) : *Dahlia* (P) propagates vegetatively by root *Begonia* (Q) propagates vegetatively by leaf and ginger (R) propagates vegetatively by stem.
17. (B) : Vegetative propagule of plants in group I is stem, so *Dahlia* is misplaced here as it propagates by roots. Vegetative propagule of plants in group II is root, so potato is misplaced here as it propagates by stems.

Vegetative propagule of plants in group III is leaf so carrot is misplaced here as it propagates by roots.

18. (B)

19. (C)

20. (A) : Crops grown in winter are called rabi crops whereas crops grown in summer are called kharif crops. Seeds of *Xanthium* are dispersed by animals whereas seeds of dandelion are dispersed by wind.

SOF NSO 2018 QUESTIONS

1. (C) : Pine tree and moss are non-flowering plants. Pine tree is a coniferous plant, it reproduces through seeds, whereas moss reproduces through spores. Ginger reproduces through stem, which is negatively geotropic plant part. Ginger and *Dahlia* are flowering plants. *Dahlia* reproduces through root, which is positively geotropic plant part.

2. (A) : Seeds of Z are dispersed in a small restricted area, so, it could be balsam, as balsam seeds get dispersed by explosion.

3. (D) : Seeds of X are dispersed in a small restricted area, so it could be pea, as pea seeds get dispersed by explosion. Seeds of Y are dispersed or scattered over a large area, so it could be maple, as maple seeds have wings and they get dispersed by wind. Seeds of Z grow near water body, so it could be dispersed by water.

4. (C) : The transfer of pollen grains from anthers to the stigma is known as pollination. After pollination, the male sex cell and female sex cell unite to form zygote and later ovules develop into seeds. This process is known as fertilisation. After fertilisation, seeds are scattered away from the parent plant by different modes of dispersal. At last, the seed produces a baby, plant or seedling by germination.

5. (B) : Seeds of X are dispersed over a broad range of area, so it could be dispersed by wind, as fruits or

seeds dispersed by wind have wings attached to them which help them to float in air for long distances. Seeds of Y are dispersed variously over distance, so it could be dispersed by animals. Seeds of Z are dispersed over a small distance so it could be dispersed by explosion.

6. (D) : The seeds of plant S are dispersed in a small restricted area, so it could be pea plant, as pea seeds get dispersed by explosion.

7. (B) : *Eichhornia* and strawberry both use stem buds for natural vegetative reproduction.

8. (D) : The seeds of castor and balsam are dispersed by explosion whereas the seeds of *Xanthium* are dispersed by animals. The seeds of apple, papaya and peach are dispersed by animals. The seeds of madar, dandelion and *Hiptage* are dispersed by wind. The seeds of coconut, lotus and water lily are dispersed by water.

9. (D) : The seed dispersal method shown in the figure is of dispersal by wind. This type of seed dispersal can carry seeds to far off places.

10. (C) : Seeds of *Xanthium* are dispersed by animals.

11. (B) : Ginger reproduces by the stem buds. In the given figure, X, Y and Z are potato, turnip and onion respectively. Potato and onion reproduce in the same way as the ginger plant.

12. (B) : The given diagram of seed has two cotyledons, such plants are called dicots. Pea and bean are dicot plants.

13. (C) : *Bryophyllum* and *Begonia* reproduce vegetatively from their leaves while sugarcane reproduces vegetatively through its stem. Potato, ginger and onion reproduce from stems. The roots of sweet potato, *Dahlia* and carrot give rise to new plants. *Hibiscus*, *Bougainvillea* and rose reproduce from stem.



Natural Resources and Indian Heritage

Learning objectives

4.1 Air, water and soil

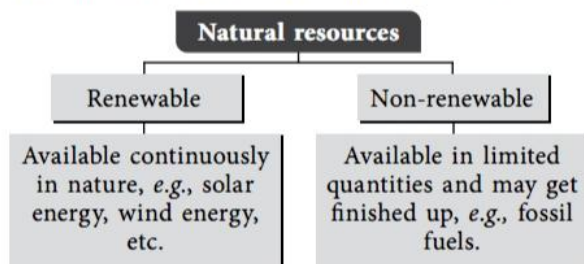
4.2 Rocks and minerals

4.3 Forests

4.4 Indian heritage

Resources that are present in the environment and have not been brought about by any human activity are called as **natural resources**. These resources are useful for the mankind.

Natural resources can be classified as follows:



The important natural resources are air, water, land, forests, fossil fuels, solar energy, wind energy, hydroelectric sources, mineral deposits, etc.

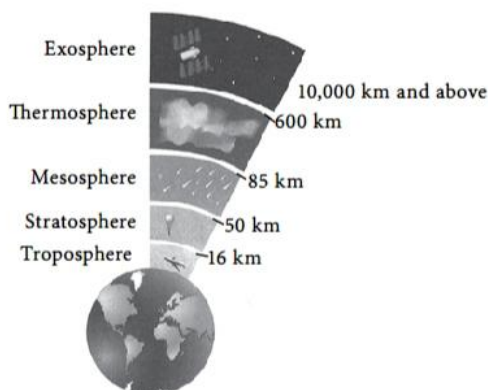
4.1 AIR, WATER AND SOIL

Air and Atmosphere

Air is present all around us. We cannot see it but we can feel its presence. Leaves rustle, clothes sway on clothesline, branches of tree move because of movement of air. The thick blanket of air that surrounds the Earth is called **atmosphere**.

It is a mixture of several gases mainly nitrogen, carbon dioxide, oxygen, hydrogen, etc. Atmosphere makes the Earth hospitable to all living organisms. It protects us from harmful ultraviolet rays of Sun and it also helps to keep Earth warm by trapping the heat of Sun. Atmosphere is held around Earth by the Earth's gravity.

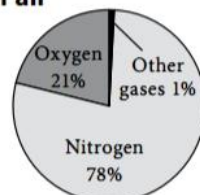
The atmosphere is divided into five layers — **troposphere**, **stratosphere**, **mesosphere**, **thermosphere** and **exosphere**.



Layers of the Earth's atmosphere

- Troposphere is the first layer above Earth's surface. All weather changes take place here. It extends upto 16 km from the earth's surface.
- Stratosphere is an important layer as it contains ozone gas that absorbs harmful ultraviolet rays of Sun and protects us from its harmful effects. It extends from 16 to 50 km above the Earth's surface.
- Mesosphere layer prevents small rocks and meteorites from reaching Earth's surface. It extends from 50 to 85 km above the Earth's surface.
- Thermosphere is the fourth layer where many satellites and space shuttles orbit Earth. It extends from 85 to 600 km above the Earth's surface.
- Exosphere is the fifth layer. It is the outermost layer of Earth's atmosphere. It extends from about 600 km above the Earth's surface to the outer space.

Components of air



Composition of air

The air that surrounds us is a mixture of several gases. It contains about 78% nitrogen and 21% oxygen. The remaining 1% is made up of other gases such as argon (0.9%), neon, hydrogen, helium, ozone and carbon dioxide (0.03%). Water vapour is also present in air. Air is humid, when there is more water vapour in it. Air is dry, when there is less or no water vapour in it. The amount of water vapour in the air is called **humidity**. It varies from place to place. Air also contains dust particles and smoke. Too much dust and smoke leads to air pollution. Smoke and fog combine together to form **smog**. Smog affects visibility.

Uses of air

- Almost all living organisms need oxygen to survive. They take in oxygen from air through the process of breathing.
- Oxygen also supports burning.
- Nitrogen is an essential nutrient for plants and other organisms. But they cannot directly use the nitrogen present in the air. Special bacteria in the soil convert the nitrogen in air into a form that can be used by plants. From plants, the nitrogen reaches other organisms.

- Nitrogen does not support burning hence, it helps in controlling fire.
- Plants need carbon dioxide along with water, minerals and sunlight to make food. All other organisms either directly or indirectly depend on the food prepared by plants.
- Moving air is called wind. Wind energy is also a natural resource. Wind helps parachutes, gliders and kites to move. It can push sail boats. Wind helps clothes to dry. Wind can also turn the blades of a windmill to draw water or generate electricity.

Properties of air

- Air is colourless, odourless and is present everywhere.
- Air occupies space.
- Air has weight.
- Air can be compressed. Balls, tyres, etc., have compressed air in them.
- Air exerts pressure.
- Air is needed for burning.
- Air expands on heating and rises up. Hot air balloons work on this property of air.

SELF TEST - 1

1. In which layer of atmosphere ozone is present?
(A) Troposphere (B) Stratosphere
(C) Mesosphere (D) Exosphere
2. Which of these gases present in air cannot be used directly by plants and animals?
(A) Oxygen (B) Carbon dioxide
(C) Nitrogen (D) None of these
3. Which of these gases present in air do not support burning?
(A) Oxygen (B) Carbon dioxide
(C) Nitrogen (D) Both (B) and (C)
4. Which property of air is used in the given figure?
(A) Air exerts pressure.
(B) Air has weight.
(C) Air occupies space.
(D) Air is needed for burning.
5. Component of air used for making food by plants is present in what percentage in air?
(A) 78% (B) 21%
(C) 1% (D) 0.03%



Water

Water is essential for life. About 70% of the Earth's surface is covered with water. It is present in oceans, rivers, lakes, ponds, etc. Water also exists in air as water vapour and under the ground as groundwater.

Almost all activities performed by us require water. We need water for drinking, bathing, day-to-day household activities, irrigating fields, generating electricity, industrial activities, etc.

It is necessary to drink pure water as impure water can make us ill. Rain is the purest form of natural water. But rain can dissolve certain impurities from air, as

well as certain living and non-living things. Therefore, it is necessary to purify water before drinking.

Types of impurities present in water

Soluble impurities
Impurities that dissolve in water, e.g., salt.

Insoluble impurities
Impurities that do not dissolve in water. They either float on surface or settle at the bottom, e.g., sand, mud, plastic bottles, etc.

Separation of soluble impurities

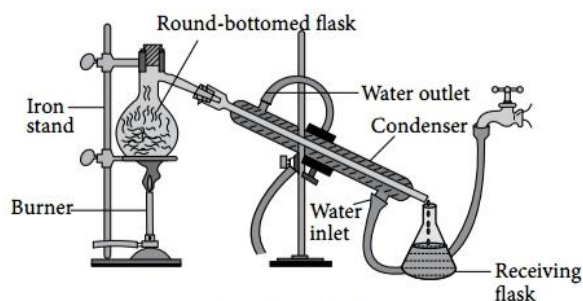
Soluble impurities can be separated by evaporation and distillation.

Evaporation: This is a very simple method of separating impurities like salt from water. Take impure water in a vessel and heat it. After sometime, the water in the vessel turns into vapour and the impurities are left behind.



Evaporation

Distillation: Distillation is another water purification process. It is carried out in a special apparatus consisting of a round-bottomed distilling flask, a water condenser, a receiving flask and a burner. In distillation, contaminated water is heated until it starts boiling. This boiling water slowly changes into steam leaving behind the impurities in the flask. The steam then passes through the condenser and gets cooled, thereby turning back into liquid water. This clean water gets collected in the receiving flask.



Distillation unit



Olympiad Bite

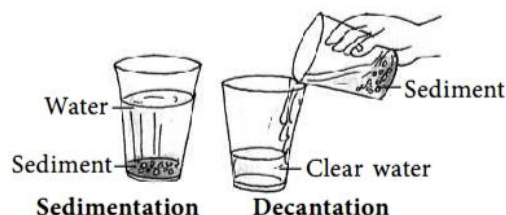
Solubility of water increases with increasing temperature.

Separation of insoluble impurities

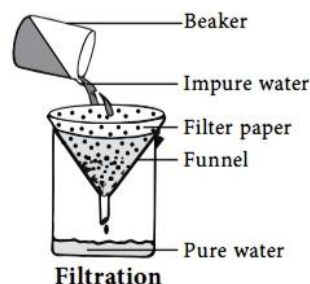
Insoluble impurities can be separated by methods of sedimentation, decantation and filtration.

Sedimentation and decantation: Settling down of heavy impurities at the bottom of a vessel is called

sedimentation. Once these impurities settle down, clear water is slowly poured into another jar. This is known as **decantation.** Both these processes together are suitable for purifying water contaminated with insoluble impurities.



Filtration: The method in which impure water is made to pass through a filter paper to remove impurities is called **filtration.** Filter paper acts like a sieve and does not allow impurities to pass through it. The impurities remain on the filter paper and clear water is obtained. This technique helps to remove very small impurities that are not removed by sedimentation and decantation.



Water treatment plant

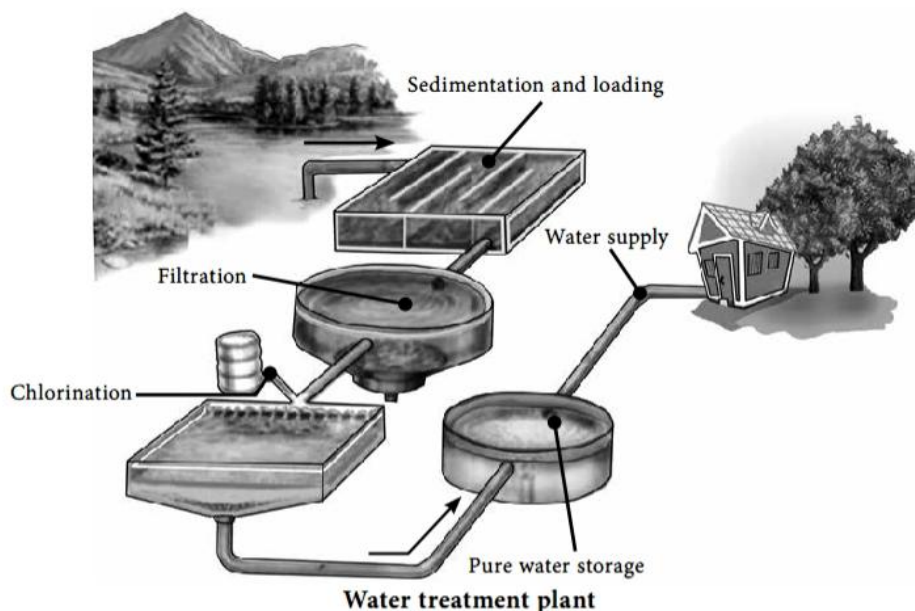
Water supplied to our homes is first treated at water treatment plant to remove impurities. Three methods are mainly used for treatment of water.

Sedimentation: Water collected in large open tanks is left undisturbed for a few days, so that the heavier suspended impurities sink to the bottom. Air and sunlight kill many harmful bacteria. Chemicals like alum are also added to speed up sedimentation.

Filtration: After sedimentation, the water is filtered through a clean sandbed to remove finer suspended particles.

Chlorination: Water is then disinfected with a very small quantity of chlorine gas to kill bacteria. This water is now safe for human consumption.

Although the water supplied to our homes is properly treated but it is still not very safe for drinking as it may have some dissolved salts, dirt and germs.



Purification of drinking water at home

Clean drinking water is a basic human need. Contaminated water can cause diseases. Therefore, water needs to be purified to make it fit for drinking. Water can be purified at home by the following methods :

Boiling : It involves boiling water for at least 10 minutes. The heat in the water kills germs present in it. This boiled water can be cooled, filtered and then stored for consumption.

Water purifiers : Water purifiers work on **reverse osmosis** process. In this process, water is passed through a semipermeable membrane or filtering sheet which removes impurities. It is a very effective process of water purification.

Chlorination : Chlorine tablets or potassium permanganate crystals can be added in water to kill germs.

Filtration : Filters are commonly used at homes and contain one or two filter candles made of clay. These candles filter and remove insoluble impurities.

Sedimentation : Water is stored in a container and allowed to stand for some time. All the insoluble impurities settle down at the bottom to speed up sedimentation, a piece of **alum** is put in the water. Alum particles get loaded with the suspended particles in water which makes them heavy and they settle down at the bottom. This process is called **loading**.

Soil

The uppermost layer of Earth's crust in which plants grow is known as **soil**. Without soil, there would have been no plants on Earth. Soil helps plants to grow by holding their roots firmly and it also provides water and essential nutrients to them. Soil is also home to a number of animals and microorganisms.

Types of soil

Sandy soil

It does not hold moisture as it has big air spaces between its soil particles. Thus with water all other essential nutrients also flow away. Due to this, it needs regular addition of fertilisers.

Clayey soil

It is usually rich in nutrients. It can hold moisture as it has small air spaces between its soil particles. But it forms hard lumps when wet. It also develops cracks in hot weather causing harm to the roots of the plants.

Loamy soil

It can hold adequate moisture and is rich in nutrients. It is a mix of both sandy and clayey soil. Hence, it is best suited for plant growth.

Composition of soil

Soil consists of a number of components, *i.e.*, humus, minerals, water, air and soil particles (gravel, sand, clay, etc.). Living organism, *i.e.*, earthworm, snail, insects and other microorganisms like bacteria and fungi are also present in soil.



Olympiad Bite

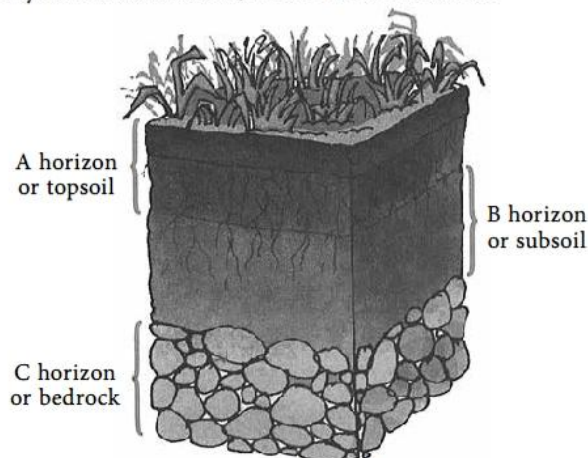
- Earthworms are known as farmer's friends. They bury deep in soil, turn it and so make it loose. Their movement helps to bring the nutrients that are present deeper in the soil to the upper soil layers. This improves the fertility of soil and helps in soil aeration.
- Bacteria and fungi also help in the complete breakdown of dead plants and animals. This process releases the nutrients back to the soil, thus enhancing its fertility.

Soil formation

Soil is formed by breaking down of rocks due to the action of wind, water, temperature and microorganisms. This process is called **weathering**. Formation of soil is a very slow and continuous process that takes thousands of years to complete.

Soil profile

The layers of soil are referred to as soil profile. These layers are horizons A, B and C and bedrock.



Soil profile

- **Topsoil or A horizon** is the fertile layer of the soil. It contains **humus** mixed in soil particles, air and water. Plants obtain nutrients from this layer.
- **Subsoil or B horizon** has water. The roots of plants may grow till here. It contains very less amount of organic matter.
- **Bedrock or C horizon** contains the parent rock from which soil particles form due to erosion and weathering. Water is scarce in this layer.

Soil erosion

Removal of top fertile layer of soil by wind, water or other factor is known as **soil erosion**. It results in loss of top fertile soil. Loss of fertile soil makes the land unsuitable for farming.

Causes of soil erosion

Wind : Due to wind, a lot of top soil is blown away. Especially in desert areas, strong winds carry a lot of sand with them and deposit them to far off places.

Water : It refers to soil erosion due to rain and running water like floods, etc. Heavy rainfalls result in the removal of top soil. This has worse effect in hilly regions. Water flows at great speed down the hills and loosens the particles of soil. This results in washing away of the nutrient-rich top soil, making the land barren. Moving water like a river flowing down a hill also washes away top soil and mud along with it.

Deforestation : One of the main reasons for soil erosion is deforestation. Roots of the trees hold the soil particles together. In their absence, soil becomes loose and is easily carried away by wind or water.

Overgrazing and other causes : Overgrazing by animals also results in soil erosion. Forest fire and poor farming methods also cause soil erosion.

Soil conservation

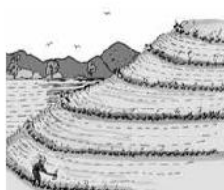
The process of soil formation is very slow. It takes hundreds of years to form an inch thick layer of soil. It is necessary that we must protect the soil from getting eroded away. To prevent soil erosion, we must follow the given practices :

Afforestation : Planting more trees is the most efficient way of reducing erosion. Trees break the flow of wind and water.

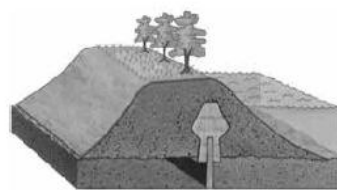
Plant covers : Farmers must grow trees or hedges around the fields to break the flow of wind. In the period between harvesting and sowing of new crop, the soil is left bare and loose. Farmers can grow grass in the field or cover the land with dried vegetation.

Terrace farming : The slope of the hills can be cut in steps. This slows the flowing water. Terrace farming done on these steps helps in reducing soil erosion.

Embankments : Building embankments along the river banks prevents soil erosion caused due to the running river water.



Terrace farming



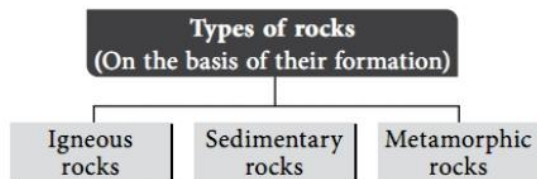
Embankment

SELF TEST - 2

1. Take a tray and fill it partially with soil, forming a heap. Keep this tray over the table and switch on the fan. You will observe that soil is blown away by wind. This activity demonstrates that
 - (A) Wind causes soil erosion
 - (B) Soil is made up of sand, gravel and clay
 - (C) Microorganisms are present inside the soil
 - (D) Water causes soil erosion.
2. Soil erosion is not caused by
 - (A) Cattle grazing
 - (B) Afforestation
 - (C) Sandstorm
 - (D) Heavy rain.
3. Which of the following types of soil is best suited for plants?
 - (A) Sandy
 - (B) Loamy
 - (C) Clayey
 - (D) None of these
4. Insoluble impurities are separated from water by _____ method.
 - (A) Filtration
 - (B) Evaporation
 - (C) Distillation
 - (D) Both (B) and (C)
5. Which of the following protects the soil from getting eroded away?
 - (A) Ploughing
 - (B) Overgrazing
 - (C) Embankment
 - (D) Rainwater

4.2 ROCKS AND MINERALS

Our Earth is made up of three layers, i.e., crust, mantle and core. The crust is made up of rocks and soil. Rocks are made up of minerals. A mineral is a natural non-living substance. Rocks may contain one or more minerals. The type of a rock depends on quality, quantity and arrangement of minerals in it.



Igneous Rock

The Earth's core contains molten rock called **magma**. As magma moves towards the Earth's surface, it begins to cool and hardens to form solid igneous rock. Under high pressure, magma comes out through the opening of the Earth crust, i.e., volcanoes and cracks. When molten magma flows on Earth's surface it is called **lava**. This lava also cools and hardens to form igneous rocks. Different types of igneous rocks are granite, pumice, obsidian and basalt.

Granite

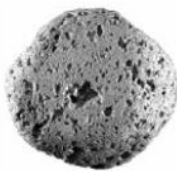
- When magma cools beneath Earth's surface, it forms granite. It is the most common igneous rock.
- It consists of minerals, such as mica, quartz and feldspar.
- It is usually white, grey or pink in colour.
- It is used for making statues, floors and kitchen counters.



Granite

Pumice

- It is formed when lava cools down quickly on Earth's surface.
- It has many holes that form when the gas entrapped within the lava escapes out during cooling.
- It is the lightest rock in the world. It is the only rock in the world that can float on water.
- It is used as a body scrubber. It is used for polishing floors. Its powdered form is used by dentists for polishing teeth.



Pumice



Pumice stone is used as foot scrubber

Obsidian

- It is formed due to quick cooling of lava.
- It is very smooth and shiny rock, also known as **natural glass**.
- It is very brittle. It can be made very sharp to make cutting tools. Surgeons use obsidian knives for eye surgery.



Obsidian

Basalt

- It is formed when volcanic lava quickly cools down and hardens on Earth's surface.
- It is a heavy and hard rock.
- It is rich in minerals, like iron and magnesium.
- Since it is a very hard rock, it is used as a grinding stone in mills.



Basalt



Basalt rock is used as grinding stone

Sedimentary Rocks

Sedimentary rocks are formed by weathering and erosion of rocks due to rain, wind and running water. Small fragments of rock, clay, sand, pebbles are washed away and deposited in the water bodies, which form a layer of sediment. Over a million of years, the pressure turns these layers into sedimentary rocks. Dead aquatic animals sank to the bottom of the sea during sedimentation. Similarly dead land animals got buried in layers of sand. These buried dead organisms and their casts got preserved in the sedimentary rocks as **fossils**. Examples of sedimentary rocks are sandstone, shale, limestone and conglomerate.

Sandstone

- It is formed when particles of sand are compressed because of high pressure and they get cemented together.
- The main mineral present in sandstone is quartz.
- It is used for making buildings. The Red Fort in Delhi is made of red sandstone.



Sandstone



Red Fort is made of red sandstone

Limestone

- It is formed from shells and skeletons of tiny sea creatures.
- The main mineral present is calcite or calcium carbonate which comes from sea animals.
- Chalk is a limestone rock.
- Limestone is used in making cement and bricks.



Limestone

Conglomerate

- It is formed when pebbles and gravels get cemented together with sand and minerals.
- It is used as ornamental stone and as fill material for construction.
- They have uneven texture and can be grey or orange in colour.



Conglomerate

Shale

- It is formed of clay particles that have been hardened together under high pressure.
- It typically breaks into thin, flat layers.
- It is used in making ceramics, cement tiles and bricks.



Shale

Metamorphic Rocks

They are formed from igneous or sedimentary rocks. When these rocks are subjected to intense heat and pressure inside the Earth, the mineral contents of these rocks rearrange. Types of metamorphic rocks are marble, slate, quartzite and gneiss.

Marble

- It is formed from limestone.
- It is found in different colours, but white marble is the most common.
- It is a stronger than limestone.

- Polished marble is used for making statues and floorings.



Marble



Taj Mahal is made from white marble

Quartzite

- It is formed from sandstone.
- It is rich in mineral quartz.
- It is a hard rock that is used as slabs and table tops, as a decorative stone, etc.
- They can be colourful depending on the impurities.



Quartzite

Slate

- It is formed from shale.
- It breaks into flat and thin layers, like shale.
- Its colour varies from grey to black.
- It is used to make slates, blackboards and roof tiles.



Slate

Gneiss

- It is formed from granite.
- It has dark and light bands.
- It is used as building materials.



Gneiss



Gneiss rocks were used in making statues in Egypt

Minerals

Minerals are naturally occurring substances with definite chemical composition. Different types of minerals are metallic, non-metallic and energy minerals.

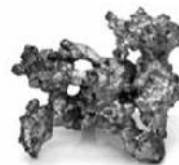
Metallic minerals

Metallic minerals are those which contain one or more metallic elements *e.g.*, iron, aluminium, copper and zinc are obtained from their ores called hematite,

bauxite, chalcopryrite and sphalerite respectively. These metals are used for making utensils, machines, furniture, wires, coins, etc. Precious metals like gold, silver and platinum are used for making jewellery.



Gold



Copper

Metallic minerals

Non-metallic minerals

Non-metallic minerals in raw form do not contain metals, *e.g.*, quartz, mica, silica, sand, talc, coal, etc. Non-metallic minerals are generally found in sedimentary rocks. They form crystals like diamond, emerald and ruby, which are precious stones and are used in jewellery.



Gemstones

Non-metallic minerals

Energy minerals

Energy minerals are also called **fossil fuels**. They are formed when the remains of plants and animals get buried under the Earth for million years and are acted upon by extreme heat and pressure under the Earth's surface.

Coal : It is the most abundant fossil fuel found on Earth. It is of four types – peat, lignite, bituminous and anthracite. Coal is used as a fuel all over the world for generating electricity and in steel plants to make steel. The chief producers of coal in the world are China, USA, India, Russia, South Africa, Germany and Australia. In India, coal mines are situated in Raniganj (West Bengal), Singareni (Andhra Pradesh), Dhanbad and Bokaro (Jharkhand).

Petroleum : Petroleum is also called **crude oil** or **black gold**. It is found between the rocks and is drilled from oil fields located in offshore and coastal areas.

It is then refined to obtain diesel, petrol, kerosene, wax, lubricants, etc. The chief petroleum producing countries are Iran, Iraq, Saudi Arabia and Qatar. The other major producers are USA, Russia, Canada and Algeria. In India, petroleum is obtained from Digboi in Assam, Ankaleshwar in Gujarat, Bombay High in Mumbai and deltas of Krishna and Godavari rivers.



Coal



Crude oil

Energy minerals

SELF TEST - 3

- Igneous rocks are formed by
(A) Cooling of lava (B) Sediments
(C) Metamorphic rocks (D) Sandy soil.
- Mineral present in granite is _____.
(A) Mica (B) Quartz
(C) Feldspar (D) All of these
- Gneiss is a type of
(A) Igneous rock (B) Metamorphic rock
(C) Sedimentary rock (D) Energy mineral.
- Red fort of New Delhi is made up of
(A) Granite (B) Shale
(C) Sandstone (D) Marble.
- Select the correct statement.
(A) Limestone contains the mineral lignite.
(B) Sandstone is used as a body scrubber.
(C) Bedrock contains the humus.
(D) Petroleum is also called black gold.

4.3 FORESTS

Forests are large areas of land covered with trees, shrubs and herbs. They are an important natural resource. Climate, soil and water determine the kind of plants in a particular forest. The plants in a forest grow naturally hence they are referred to as natural vegetation.



Importance of Forests

Forests help us in many ways :

- Trees of forests give us food, fresh air, wood, pulp, gums, resins, rubber, lac, oil, etc.
- We get many types of medicines from forests.
- Forests help to regulate water cycle and bring rainfall.
- They also prevent soil erosion.
- They provide shelter to many animals and birds.
- They control floods and landslides.
- They purify the air by taking in carbon dioxide and releasing oxygen in air.
- Forest soil soaks up the rainwater and recharges the groundwater.

Tribal Life

Many tribal communities also known as *adivasis* live in forests. In India, states like Madhya Pradesh, Jharkhand, Chhattisgarh, Orissa, West Bengal and North-Eastern states have a significant tribal population. *Gonds* are one of the largest tribal groups in India, followed by *Bhils* and *Santhals*.



Tribals

Tribals depend on forest for food, shelter and all other needs. They wear ornaments made of glass beads, shells, ivory and metal. Tribals love to sing and dance during religious and agricultural festivals. They have their own beliefs and traditions. They do not worship god in any particular form. They believe that god is present in everything around them, be it a stone or a tree.

Due to increase in population and urbanization, land requirements are increasing. To meet them, forests are being cut down at a very fast pace. Due to this, tribals are being uprooted from places where they have been living for generations. Some tribes are even becoming

extinct. For example, the *Bo* tribe that lived on the Andaman islands for about 65,000 years is now extinct. Another endangered tribe is the Great Andamanese tribe.

Deforestation

We are aware that human activity has resulted in cutting down of trees, also called **deforestation**.



Cutting as trees

It has many bad effects:

- Deforestation destroys the habitat of most of the animals.
- Lack of trees leads to decrease in oxygen level in atmosphere.
- It will also leads to soil erosion.
- Rainfall also will be greatly affected by deforestation.
- Deforestation is a key cause for the increasing level of carbon dioxide in atmosphere. It is a greenhouse gas which causes increase in Earth's temperature, also called **global warming**.
- Many tribal people lose their homes and sources of food and move to cities and towns as a result of deforestation.

Protection of Forests

Destruction of forests is causing an imbalance in the nature. Forests must be protected to save the environment for future generations. Government, private organisations and tribal people have come forward for conservation of forests and wildlife

- The government look after and has opened many National Parks, Biosphere Reserves and Wildlife Sanctuaries for the conservation of forests and wild animals.
- **Vanmahotsav** (afforestation) is a festival of tree plantation started by a noted environmentalist, K.M. Munshi in 1950. It is organised in the month of July for one week. Thousands of people participate in this festival and plant lakhs of trees every year.



Planting trees

- Some patches of forests are worshipped, these are called **sacred groves**. They are conserved for tribal people. They are areas in the forest which contain trees that are on the verge of extinction. Cutting of trees is strictly prohibited in these groves. They are known by different names at different places, e.g., *Kavis* in Kerala, *Shipin* in Himachal Pradesh, *Sarnas* in Bihar, *Devkot* in Madhya Pradesh, *Oran* in Rajasthan and *Devrai* in Maharashtra.

Chipko movement

In early 1970s' some timber contractors went to cut the trees in the Terai forest of Garhwal in Uttarakhand. Some local women decided to prevent this deforestation. They embraced the trees and were ready to give up their lives to prevent them from being cut. This movement is called **Chipko Movement**.

The movement gradually spread to the entire country. Gaura Devi, Sunderlal Bahuguna and Chandi Prasad Bhatt are some famous leaders of this movement.



Olympiad Bite

For the *Bishnois* of Rajasthan, preservation of animal and plant life is a religion. *Bishnoi* religion was founded by Guru Jambheshwar, who made some principles which included a ban on killing of animals and felling of trees to protect all life forms. Amrita Devi, a *Bishnoi* woman, is a very famous conservationist. She used to cling to trees to protect against their felling.

4.4 INDIAN HERITAGE

India has a rich historical past. Rulers from different cultures that have ruled this country built many structures to remember a special person or an event. These structures are called **monuments**. Historical buildings and monuments have various styles of architecture, painting, sculpture and other crafts.

There are many historical monuments in India. Each monument has its unique history.

Historical Monuments

Monuments can be in form of a building, tomb, fort, palaces, etc. Some historical monuments are :

Taj Mahal

The Taj Mahal is one of the seven wonders of the world. It is situated on the banks of river Yamuna in the city of Agra. It was built by emperor Shah Jahan in the memory of his wife Mumtaz Mahal. It took approximately 22 years to construct the monument. Artists and architects from different parts of the world were brought for its construction. The Taj Mahal was designed by a Persian architect, Ustad Ahmad Lahauri. It is made of white marble brought from Rajasthan. It is built on a raised terrace with graceful tall minarets. The walls are carved with flowers and inlaid with precious stones.



The Taj Mahal

Qutub Minar

The Qutub Minar is a tall and very famous minaret located at Mehrauli in Delhi. Its construction was started by Qutub-ud-din Aibak, continued by Iltutmish and completed by Firoz Shah Tughlaq. It is 73 m high and has spiral staircase of 379 steps. It has five storeys and each has a different design. The lower three storeys are made using red sandstone and the top two with marble and sandstone. It was used by the priests to give the call for prayer.



Qutub Minar



Olympiad Bite

Qutub Minar is surrounded by several other structures such as Iron Pillar, Alai Darwaza and tombs of Iltutmish, Ala-ud-din khilji and Imam Zamin. These structures together with the Qutub Minar form the Qutub Complex.

Sun Temple

The Sun Temple of Konark (Odisha) built by King Narasimhadeva. Around the base of temple there are images of animals, foliage,



Sun Temple

warriors on horses, etc. On the walls and roof of the temple, beautiful erotic figures are carved.

Jantar Mantars

Jantar Mantars were built by Maharaja Jai Singh II. He constructed five Jantar Mantars which are located in Delhi, Jaipur, Varanasi,



Jantar Mantar

Ujjain and Mathura. Each Jantar Mantar has several instruments, that are used for measuring time, forecasting weather changes and predicting movements of the Sun, the Moon and other planets. The Jantar Mantars can still be used to tell the time accurately.

Gateway of India

The Gateway of India is a 26 m high structure with four turrets and intricate lattice work on the waterfront at Apollo Bunder in Mumbai. It was designed by the British architect George Wittet and was built to commemorate the visit of King George V and Queen Mary to Mumbai in 1911. It is made of yellow basalt and concrete. Its design is a combination of Hindu and Muslim architectural style.



Gateway of India

Protecting Monuments

Historical monuments help us to know about our glorious past. But they are facing risk due to increased pollution from vehicles, industrial pollution, ill-planned development, floods, other natural disasters and lack of proper maintenance.

As visitors, it is our duty to take care of historical monuments. While visiting them, we should take care of the following things:

- We should not scratch or write on their walls.
- We should abide by the rules laid down by the government to preserve them.
- We should not throw garbage around them.
- We should discourage people who try to disfigure or damage them.

Cultural Heritage

India has a rich cultural heritage. Cultural heritage means things such as traditions, music, architecture, etc., passed on to us by our ancestors.

17 major languages are spoken in our country. India is also rich in literature. Literature tells us about the way people have lived, felt and thought.

Music

Almost every part of India has its own music. **Folk music** is song and played by common people while working or celebrating. **Classical music** is played by experts, it has certain rules which people have to learn with years of practice. In India there are two styles of classical music, i.e., **Hindustani** and **Karnatak**. Each style has its own **ragas**. In India music notes are sa, re, ga, ma, pa, dha, ni. Sitar, sarod, sarangi, veena, tabla, dholak, mridangam, ghatakam, etc., are some common musical instruments used by our musicians while playing music.

Dance

Every part of India has its own kind of dance called **folk dance**. Other than folk dance there are classical dances that have to be learned by people for years.

Table : Folk dance forms of different states

	Name of folk dance form	State
(i)	Ghoomar	Rajasthan
(ii)	Bhangra	Punjab
(iii)	Lavani	Maharashtra

(iv)	Yakshagana	Karnataka
(v)	Chhau	West Bengal
(vi)	Thang Ta	Manipur
(vii)	Cheraw or bamboo dance	Mizoram
(viii)	Garba	Gujarat

Table : Classical dance forms of different states

	Name of classical dance form	State
(i)	Bharatanatyam	Tamil Nadu
(ii)	Kuchipudi	Andhra Pradesh
(iii)	Odissi	Odisha
(iv)	Manipuri	Manipur
(v)	Kathakali	Kerala

Art

Painting and sculpture are two forms of art. Ajanta caves in Maharashtra have more recent paintings made by Buddhist monks. They show life of Buddha. Different painting styles developed in India are Mughal, Kangra and Rajasthani.



Cave painting of Panchmarhi



Painting of Ajanta



Painting of Mughal style

SELF TEST - 4

- Sun temple is located in
(A) Odisha (B) Kerala
(C) Rajasthan (D) Jammu and Kashmir.
- Patches of forest worshipped by tribal people are called
(A) States (B) Union territories
(C) Sacred groves (D) Islands
- Forest provides us
(A) Food (B) Pure air
(C) Medicine (D) All of these
- Select the odd one out.
(A) Thang Ta (B) Kathakali
(C) Garba (D) Lavani
- Select the incorrect statement.
(A) The Gateway of India is a 73 m high structure.
(B) Qutub Minar is located in Mehrauli.
(C) Vanmahotsav was started by K.M. Munshi in 1950.
(D) Deforestation can affect the rainfall greatly.

EXERCISE

1. Ashok irons clothes to earn his bread. He uses coal in his iron for ironing clothes. He is using

- (A) Man-made source of energy
- (B) Non-renewable source of energy
- (C) Renewable source of energy
- (D) None of these.

2. Select the incorrect statement.

- (A) 17 major languages are spoken in India.
- (B) Mridangam and Ghatakam are two classical music styles of India.
- (C) Kathakali is dance form of Kerala.
- (D) Ajanta caves depicts life of Buddha

3. The gas present in highest amount in the air is

- (A) Oxygen
- (B) Nitrogen
- (C) Carbon dioxide
- (D) Water vapour.

4. X is a liquid energy source used in vehicular transport. Identify X and select the incorrect option regarding it.

- (A) It is a fossil fuel.
- (B) It is a renewable source of energy.
- (C) It is obtained from deep down the Earth.
- (D) It takes millions of years to regenerate.

5. Identify the monument in the given figure and select the correct option regarding it.



- (A) It took 22 years to construct this monument.
- (B) It is 73 m high and has spiral staircase of 379 steps.
- (C) It is located in Odisha and was built by king Narsimhadeva.
- (D) It has several instruments that are used for measuring time

6. Read the given statements and select correct ones.

- (i) Atmosphere is held around the Earth by its gravity.
- (ii) Plants can take carbon dioxide, oxygen and nitrogen directly from air.
- (iii) Both oxygen and carbon dioxide are needed for burning.

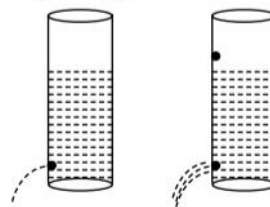
(iv) Weather forms and changes in the troposphere.

- (A) (i) and (iv)
- (B) (i), (iii) and (iv)
- (C) (i), (ii) and (iii)
- (D) (i), (ii), (iii) and (iv)

7. Take two balloons of equal size. Blow air into both of them and tie them at two opposite ends of a beam balance. Now prick one of the balloons and let air escape from it. You will observe that the side of beam balance having the air filled balloon tilts downward. This shows that

- (A) Air occupies space
- (B) Air has weight
- (C) Air exerts pressure
- (D) Air is a mixture of gases.

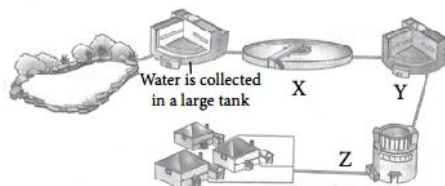
8. Refer to the given experiment.



What can be concluded from the given experiment?

- (A) Air has weight and occupies space.
- (B) Air exerts pressure.
- (C) Air is absent in the can.
- (D) Air is a mixture of gases.

9. Identify X, Y and Z in the given figure of water treatment plant and select the incorrect statement regarding them.



- (A) In process X heavier suspended impurities are separated from the water stored in large open tanks.
- (B) In process Y alum is added to purify the water by killing harmful bacteria and other disease causing germs.
- (C) During process Z water is disinfected with chlorine.
- (D) Both (B) and (C)

10. Name of few processes are given below.

Distillation, Evaporation, Decantation, Sedimentation, Filtration

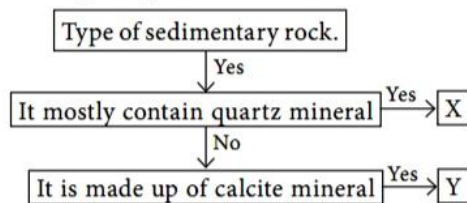
How many of these are used to remove soluble impurities from water?

- (A) 2 (B) 3
(C) 4 (D) 5

11. Select the correct statement.

- (A) Deforestation and overgrazing lead to soil erosion.
(B) Soil erosion leads to loss of top fertile layer of soil.
(C) Terrace farming is done on the hill slopes to reduce soil erosion.
(D) All of these

12. Refer to the given flow chart and select the incorrect statement regarding X and Y.



- (A) X could be a rock that was used to make Red Fort in Delhi.
(B) Y could be a rock that is used by dentists for polishing teeth
(C) Y could be a rock that is used to make cement and bricks.
(D) X could be sandstone and Y could be limestone.

13. Identify the rock from the given statements and select the correct option.

Rock X is a metamorphic rock. It breaks into thin layers. It is used to make black board.

Rock X could be

- (A) Quartzite (B) Slate
(C) Sandstone (D) Gneiss.

14. X helps in soil formation and Y contributes to soil erosion. Identify processes X and Y and select the incorrect option regarding them.

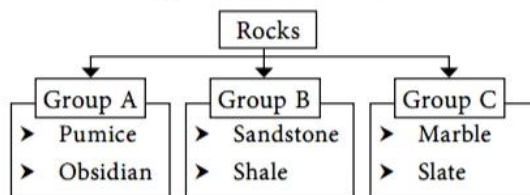
- (A) Processes X and Y require the action of water.
(B) X could be weathering whereas Y could be deforestation.
(C) X could be overgrazing whereas Y could be afforestation.
(D) None of these

15. Select the option that on unscrambling gives the name of type of non-metallic mineral.

- (A) SGISNE (B) HESLA
(C) NTISLEMOE (D) OACL

Achievers Section (HOTS)

16. Refer to the given classification table.



Select the correct option regarding this.

- (A) Granite used for making kitchen counters belongs to group C.
(B) Limestone formed from shells and skeletons of tiny sea creatures belongs to group A.
(C) Quartzite used in watches, glass, etc., belongs to group C.
(D) Obsidian used by eye surgeons belongs to group B.

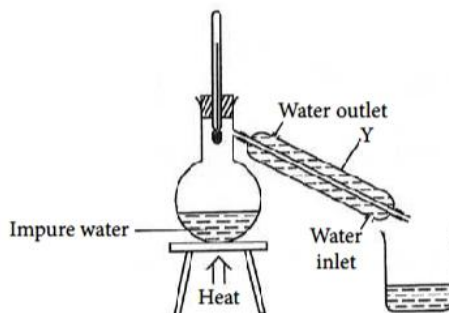
17. Select the option that correctly identifies the given statements as true (T) and false (F) ones.

- (i) Vanmahotsav was started by K.M. Munshi.
(ii) Forests help to increase rainfall.
(iii) Bo tribe is the largest tribal group of India.
(iv) Tribal people do not celebrate festivals.

(i) (ii) (iii) (iv)

- (A) T F T F
(B) F T T F
(C) T T F F
(D) F F T T

18. Refer to the given experimental set up and select the correct option regarding it.



P. This method of purification of water is called _____.

Q. Y is known as (i) and is used for converting (ii) into (iii).

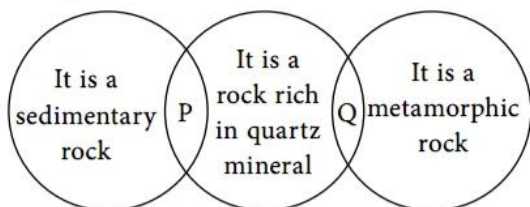
- | P | Q |
|-------------------|---|
| (A) Decantation | (i)-condenser,
(ii)-water, (iii)-steam |
| (B) Distillation | (i)-condenser,
(ii)-steam, (iii)-water |
| (C) Filtration | (i)-funnel,
(ii)-stem, (iii)-water |
| (D) Sedimentation | (i)-funnel,
(ii)-water, (iii)-steam |

19. Refer to the given paragraph where few words have been italicised and select the correct option.

The Gateway of India is *73 m* high structure with *five* turrets and lattice work on the water front at Apollo Bunder in *Delhi*. It was built in *1921*. Its design is a combination of Hindu and *Sikh* architectural style.

- (A) 73 should be replaced with 26.
 (B) Five should be replaced with Six.
 (C) Delhi should not be replaced as it is correctly mentioned.
 (D) 1921 should be replaced with 1941 and Sikh should be replaced with Muslim.

20. Refer to the given Venn diagram and select the correct option.



- (A) P is formed when particles of sand are compressed under pressure and get cemented together.
 (B) Q is formed when lava cools down quickly on earth's surface.
 (C) P is also known as natural glass and is used to make sharp cutting tools.
 (D) Q is the lightest rock in the world and the only rock that can float on water.

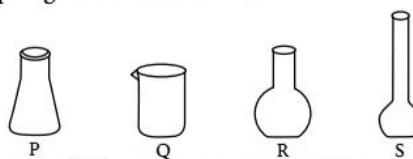
SOF NSO 2018 QUESTIONS

1. Select the option that pairs rocks of two different kinds as shown here in the box.

Sandstone : Pumice

- (A) Granite : Obsidian (B) Shale : Limestone
 (C) Slate : Marble (D) Conglomerate: Obsidian
 (Level-1)

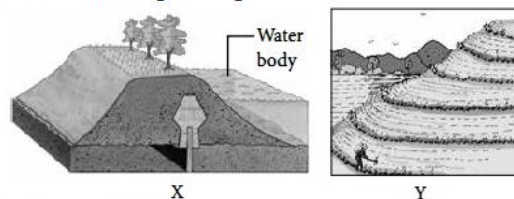
2. 200 mL of water at 25°C was poured into each of the given containers P-S. The containers were then left in an open garden under the sun.



Which of the following containers will have maximum volume of water after a few hours?

- (A) P (B) Q
 (C) R (D) S (Level-1)

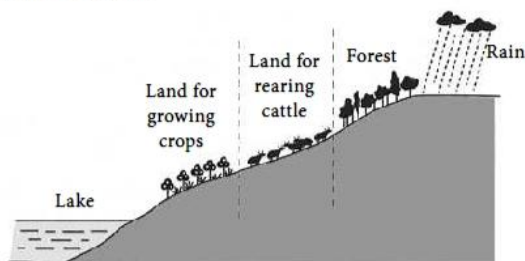
3. Refer to the given figure.



Which of the following is correct regarding X and Y?

- (A) X is a method of reducing soil erosion by wind only whereas Y is a method of reducing soil erosion by water only.
 (B) Both X and Y are practised only in mountainous regions.
 (C) X represents embankment whereas Y represents step farming.
 (D) None of these (Level-1)

4. Study the given diagram that shows how some land near a lake is used.



Which of the following is most likely to cause the lake to flood?

- (A) Cutting down the forest
 (B) Removing the cattle
 (C) Using pesticides on the crops
 (D) Growing crops (Level-1)

5. Read the given statements.

- (i) P was used for making Mount Rushmore.
 (ii) Q was used for making Taj Mahal.
 (iii) R was used for making Red Fort.

Select the option which identifies P-R.

P	Q	R
(A) Metamorphic rock	Igneous rock	Sedimentary rock
(B) Igneous rock	Metamorphic rock	Sedimentary rock
(C) Sedimentary rock	Igneous rock	Metamorphic rock
(D) Metamorphic rock	Sedimentary rock	Igneous rock

(Level-1)

6. Radhika took three beakers and poured equal amounts of three different types of soils X, Y and Z into them as shown in the figure I.

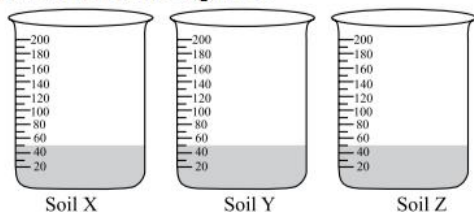


Figure I

She then poured equal amount of water into each beaker at the same time. Figure II shows the set-ups after the water has been added.

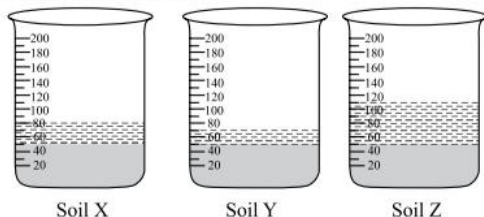


Figure II

Identify type of soils X, Y and Z and select the correct statement.

- (A) X type of soil is mostly found in deserts whereas Y type of soil is mostly found on sea shore.
 (B) Soil X can hold adequate amount of nutrients.
 (C) Soil X is difficult to plough whereas soil Z can be ploughed easily.
 (D) Bacteria and other soil organisms cannot breathe inside the soil X.

(Level-1)

7. Refer to the given relationship.

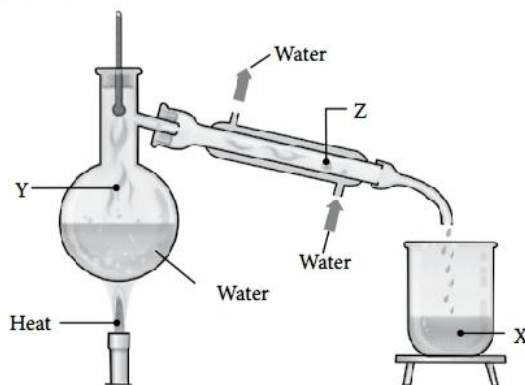
Platinum : Conglomerate : Coal

Select the option which correctly satisfies the same relationship.

- (A) Mica : Diamond : Gneiss
 (B) Silver : Shale : Petroleum
 (C) Marble : Silver : Iron
 (D) Aluminium : Copper : Gold

(Level-1)

8. Refer to the given figure representing process of distillation.



At which point the temperature will be 100°C ?

- (A) Y and Z only (B) Y only
 (C) X and Z only (D) X, Y and Z

(Level-1)

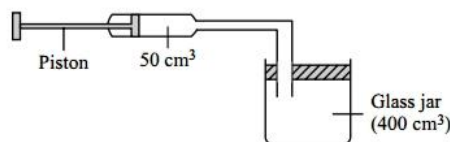
9. Which of the following soils is best suited for cultivation of paddy (X) and watermelon (Y)?

X	Y
(A) Sandy	Loamy
(B) Clayey	Sandy
(C) Sandy	Clayey
(D) Loamy	Clayey

(Level-1)

10. The given diagram shows a pump connected to a glass jar. The volume of the glass jar is 400 cm^3 and it is filled with air. When the piston is pushed in completely, 50 cm^3 of air is forced into the jar.

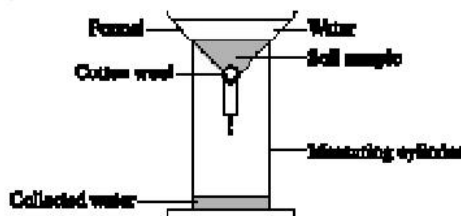
What is the final volume of air in the jar?



- (A) 50 cm^3 (B) 350 cm^3
 (C) 400 cm^3 (D) 450 cm^3

(Level-1)

11. Asha wants to carry out a fair test to find out how fast water can pass through four different kinds of soil (P, Q, R and S). She sets up an experiment as shown in the given figure. She uses a stopwatch to measure the time taken by 20 mL of water to pass through each kind of soil.



She records her findings in the table given below:

Kind of soil	P	Q	R	S
Time taken (seconds)	45	15	30	20

Based on Asha's results, identify the soil types P, Q, R and S.

- | | P | Q | R | S | |
|-----|--------|--------|--------|------|-----------|
| (A) | Gravel | Sand | Loam | Clay | |
| (B) | Sand | Loam | Gravel | Clay | |
| (C) | Clay | Gravel | Loam | Sand | |
| (D) | Sand | Gravel | Clay | Loam | (Level-2) |

12. Read the given statements and select the correct option.

Statement 1 : Greenhouse gases in the atmosphere trap the heat of the Sun and increase the temperature of the Earth.

Statement 2 : CO₂, nitrous oxide, methane and water vapour are greenhouse gases.

- (A) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
 (B) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
 (C) Statement 1 is true but statement 2 is false.
 (D) Both statements 1 and 2 are false. (Level-2)

13. Which of the following children is/are concerned about conservation of wildlife?



Sakshi

I like the items made of ivory and I frequently buy them to decorate my house.



Rishab

My grandfather had a carpet made of tiger skin. I would also buy one.

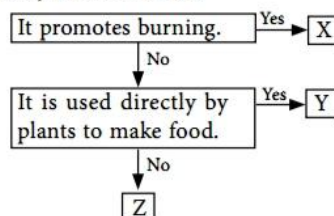


Kusum

I do not wear fur clothes and leather jackets as these cost animal lives.

- (A) Sakshi and Kusum
 (B) Kusum and Rishab
 (C) Sakshi and Rishab
 (D) Kusum only (Level-2)

14. Refer to the given flow chart and identify the components X, Y and Z of air.



- (A) X - Carbon dioxide; Y - Nitrogen; Z - Oxygen
 (B) X - Carbon dioxide; Y - Oxygen; Z - Nitrogen
 (C) X - Oxygen; Y - Carbon dioxide; Z - Nitrogen
 (D) X - Nitrogen; Y - Oxygen; Z - Carbon dioxide (Level-2)

15. Swati wanted to study the effect of temperature on the rate of evaporation. For this, she carried out the experiment under four different sets of conditions as shown in the table.

Characteristic	Set W	Set X	Set Y	Set Z
Surface area of the container	80 cm ³	120 cm ³	80 cm ³	120 cm ³
Humidity	80%	90%	90%	90%
Temperature	75°C	120°C	75°C	75°C

Which of the following is best suited to conclude the effect of temperature on the rate of evaporation?

- (A) Set W and Set Z
 (B) Set X and Set Z
 (C) Set Y and Set Z
 (D) Set W and Set Y (Level-2)

HINTS & EXPLANATIONS

SELF TEST - 1

1. (B) : Ozone is present in stratosphere layer of atmosphere.
2. (C) : Nitrogen gas present in atmosphere cannot be used directly by plants. It is first fixed into simpler nitrogenous compounds in the soil by nitrogen fixing bacteria, lightning, etc., which is then used by plants to make their proteins. From plants, it reaches other organisms.
3. (D) : Oxygen gas supports burning.
4. (A)
5. (D) : Carbon dioxide constitutes 0.03% of atmospheric air.

SELF TEST - 2

1. (A) : Blowing wind takes away the top layer of the soil, which can cause soil erosion.
2. (B) : Afforestation refers to planting of trees. Trees hold the soil particles together, hence, it helps to prevent soil erosion.
3. (B) : Loamy soil can hold nutrients and moisture in adequate amount so is best suited for plant growth.
4. (A) : Insoluble impurities are separated from water by filtration. Evaporation and distillation are methods of separating soluble impurities from water.
5. (C) : Ploughing, overgrazing and rainwater cause soil erosion while embankments prevent soil erosion.

SELF TEST - 3

1. (A) : Igneous rock are formed by cooling of magma below Earth surface or lava on Earth surface.
2. (D)
3. (B) : Gneiss is a metamorphic rock formed from granite. It is used as a building material.
4. (C)
5. (D) : Limestone contains the mineral calcite. Pumice is used as a body scrubber. Top soil contains the humus.

SELF TEST - 4

1. (A)
2. (C) : Some patches of forest are worshiped by tribal people. They are called as sacred groves.
3. (D) : Forests are large areas of land covered with

trees, shrubs and herbs. They give us food, fresh air, medicine, etc.

4. (B) : Kathakali is a classical dance form whereas Thang Ta, Garba and Lavni are folk dance forms.
5. (A) : The Gateway of India is a 26 m high structure.

EXERCISE

1. (B) : Coal is a fossil fuel. It is a natural source of energy that once exhausted will take millions of years to regenerate, so it is considered to be non-renewable source of energy.
2. (B) : Hindustani and Karnatak are two classical music styles of India.
3. (B) : Nitrogen constitutes 78% of atmospheric air, oxygen constitutes 21% of atmospheric air and other gases constitute remaining 1% of the atmospheric air in which carbon dioxide contributes 0.03%.
4. (B) : Vehicular transport is powered by petrol and diesel. These are fossil fuels obtained from deep down the Earth. It is a non-renewable source of energy and will soon get exhausted. This is because it will take millions of years to regenerate.
5. (B) : The monument shown in the picture is Qutub Minar. It is located at Mehrauli in Delhi. Its construction was started by Qutub-ud-din Aibak, continued by Iltutmish and completed by Firoz Shah Tughlaq. It has five storeys and each has a different design.
6. (A) : Plants cannot take nitrogen directly from air. They obtain it in fixed soluble form from soil. Only oxygen is needed for burning.
7. (B)
8. (B) : When a hole is made in a can filled with water then water contained in it starts coming out. When second hole is made in the can then air enters the can and its pressure pushes the juice out of the can.
9. (B) : In the given figure X, Y and Z are sedimentation, filtration and chlorination respectively.
10. (A) : Distillation and evaporation are used for removing soluble impurities from water whereas sedimentation, decantation and filtration are used for removing insoluble impurities from water.
11. (D)
12. (B) : In the given flow chart X is sandstone and Y is limestone. Dentists use powdered pumice (igneous rock) to polish teeth.

13. (B) : Rock X could be slate which is a metamorphic rock formed from shale. It breaks into flat and thin layers. Its colour varies from grey to black and it is used to make slates and blackboards.

14. (C) : Weathering is a process in which soil is formed by breaking of rocks. It is caused by the action of rainwater, extremes of temperature and biological activity. Y could be any natural or man made cause like deforestation, floods, overgrazing, etc. that can lead to loss of top fertile layer of soil.

15. (D) : Option A is GNEISS, option B is SHALE and option C is LIMESTONE. All these are rocks. Option D is COAL that is a naturally occurring non-metallic mineral also referred to as fossil fuel.

16. (C) : In the given classification chart, group A corresponds to igneous rocks, group B belong to sedimentary rocks and group C belongs to metamorphic rocks. Granite is an igneous rock, limestone is a metamorphic rock and obsidian is an igneous rock.

17. (C) : Bo tribe is an extinct tribe, that once lived on the Andaman islands for about 65,000 years. Gond tribe is the largest tribal group of India. Tribal people do celebrate festivals.

18. (B) : The apparatus shown in the figure is known as distillation unit that is used for removing soluble impurities from water. Part labelled Y is a condenser that converts steam into water (liquid).

19. (A) : 73 should be replaced with 26, five should be replaced with four, Delhi should be replaced with Mumbai, 1921 should be replaced with 1911 and Sikh should be replaced with Muslim.

20. (A) : According to the given Venn diagram P is sand stone and Q is quartzite.

SOF NSO 2018 QUESTIONS

1. (D) : The relationship in the box pairs a sedimentary rock (sandstone) and an igneous rock (pumice) together. Similarly, conglomerate is a sedimentary rock and obsidian is an igneous rock.

2. (D) : Container S will have maximum volume of water after a few hours, because it has minimum surface area for evaporation. Hence, least amount of water will get evaporated from it.

3. (C)

4. (A) : Trees bind the soil with their roots. When

forests are cut down the soil gets easily washed away with rainwater. This rainwater along with top soil will reach the lake and cause its flooding.

5. (B) : Mount Rushmore is made up of granite rock, hence P is an igneous rock. Taj Mahal is made up of marble, hence Q is a metamorphic rock. Red Fort is made of red sandstone, hence R is a sedimentary rock.

6. (B) : Soil X, Y and Z represent loamy soil, sandy soil and clayey soil respectively. Y type of soil is mostly found in deserts as well as on sea shores. Soil Z is difficult to plough whereas soil Y can be ploughed easily. Bacteria and other soil organism cannot breathe inside soil Z.

7. (B) : The given relationship in the box shows metallic mineral (platinum), sedimentary rock (conglomerate) and energy mineral (coal). Similarly, silver is a metallic mineral, shale is a sedimentary rock and petroleum is an energy mineral.

8. (B) : The given setup shows the process of distillation. The temperature will be 100°C (boiling point of water) at point Y.

9. (B)

10. (C) : When 50 cm^3 of air will be pushed inside the glass jar, the volume will remain the same as the extra air will get compressed inside the glass jar and fit in the same space provided.

11. (C) : In the given experiment time taken by water to pass through $P > R > S > Q$. So P, Q, R and S could be clay, gravel, loam and sand respectively.

12. (B)

13. (D) : Items made up of ivory and carpet made up of animal skin requires killing or harming of wild animals, hence Sakshi and Rishab are not concerned about conservation of wildlife. Kusum is concerned about conservation of wildlife as she does not wear fur clothes and leather jackets which also costs animal lives.

14. (C) : In the given flow chart, X could be oxygen as it promotes burning, Y could be carbon dioxide as it does not promote burning but it is directly used by plants to make food and Z could be nitrogen as it neither promotes burning nor it is used directly by plants to make food.

15. (B) : For studying the effect of temperature on the rate of evaporation fairly, all other factors like surface area of the container and humidity should be kept constant hence, set X and set Z are best suited to carry out this experiment.



Pollution and Calamities

Learning objectives

5.1 Pollution

5.2 Saving the environment

5.3 Natural calamities

One of the major problems that the world is facing currently is the environmental pollution. Natural disasters are also linked to environmental pollution. Changes in the global climate as a result of pollution increases the risk of natural disasters. Similarly, natural disasters can cause drastic environmental changes and generate huge amount of waste which ultimately leads to pollution.

5.1 POLLUTION

Pollution can be defined as the introduction of harmful substances into the environment that contaminate and cause adverse effects on the natural surroundings. It can be either caused by natural events or by man-made activities. The harmful substances that pollute the environment are called **pollutants**. The main types of environmental pollution are air, water, soil and noise pollution.

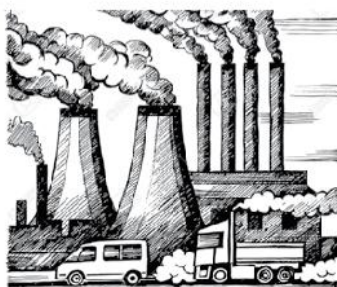
Air Pollution

Air pollution is the addition of certain undesirable substances into the air in quantities that are harmful to living beings. Substances and factors which cause air pollution are called **air pollutants**.

Some causes of air pollution are:

- Vehicles and factories release smoke into the air. This smoke contains gases that are very harmful.
- In some houses, wood or coal is used as fuel for cooking and gives out smoke that again harms the environment.
- Burning of firecrackers and stubble burning also cause air pollution.
- Volcanic eruption releases smoke into the air.

An excess of pollutants in the air makes it unfit for breathing, and results in a number of diseases of the respiratory system. Many people living in areas with heavy air pollution suffer from breathing problems and lung damage.



Air pollution

Effects of air pollution

Acid rain : Harmful gases like sulphur dioxide and nitrogen dioxide get mixed with water vapour present in air to form acids. These acids come down with rain this is called **acid rain**. Acid rain is very harmful for both plants and animals. It also destroys statues and buildings.

Ozone hole : Ozone layer is present in the stratosphere. Harmful gases (chlorofluorocarbons) released into the atmosphere have created holes in the ozone layer allowing ultra-violet rays of the Sun to reach the Earth. These rays cause skin cancer and many other diseases.

Global warming : Earth absorbs 50% of the total solar energy reaching its surface. Warm Earth emits heat in atmosphere where it is absorbed and trapped by greenhouse gases. **Greenhouse gases** present in the atmosphere like carbon dioxide, methane, water vapour, chlorofluorocarbons (CFCs), etc., do not let the heat of the Earth to escape. Thus, they help to keep the Earth's surface warm and this effect is known as the **greenhouse effect**. The increase in the concentration of greenhouse gases in the atmosphere leads to an increase in the temperature of Earth. This is called **global warming**.

The effects of global warming are : melting of polar ice caps, rise in water levels of oceans and flooding of places near the sea.

Efforts should be made to reduce the global warming. Countries, especially the ones which release more greenhouse gases, should reduce them.



Olympiad Bite

- Montreal Protocol was signed in 1987 and ratified by 197 UN member states to reduce the level of CFCs.
- International conference held in Kyoto, Japan in 1997 obtained commitments from different countries for reducing overall greenhouse gases.

Water Pollution

Water pollution is caused due to the addition of undesirable substances into the water that contaminate it. These substances are present in wastes of industries, agricultural farms, homes and hospitals. When these wastes are released into the water bodies, water becomes polluted. Agricultural run-off contains excessive amount of fertilisers and pesticides, industrial waste contains toxic chemicals and sewage waste from homes contains germs. Oil spills also pollute the water.

Effects of water pollution

- Low O_2 is caused by hot water drained in water bodies, release of plant nutrients which leads to excessive algal growth. Die off and decomposition of plant matter. Plants die if polluted water reaches their roots.
- Chemicals present in polluted water decrease the amount of oxygen in the water. So, aquatic animals die because they do not get sufficient oxygen to breathe in.
- Humans also fall ill if they drink polluted water. Cholera, typhoid, dysentery are some of the diseases caused due to drinking of impure water.

Soil Pollution

Soil pollution, also called **land pollution** refers to the

degradation of soil due to the presence of harmful substances in the soil.

Some of the causes of soil pollution are:

- Improper waste disposal by industries
- Agricultural wastes like pesticides and fertilisers
- Acid rain
- Solid wastes such as plastic bags, bottles, cans etc.

Wastes which can be broken down or decompose naturally over a period of time are known as **biodegradable wastes**, e.g., paper, wood, clothes, etc. Wastes which cannot be broken down or decompose over a long period of time are known as **non-biodegradable wastes**, e.g., plastic, metal, ceramic, etc. Non-biodegradable materials pose a great challenge in keeping the environment clean.

Soil pollution affects both plants and animals. Plants do not grow well in polluted soil. Animals that feed on plants growing in polluted soil often fall ill.

Noise Pollution

Noise pollution is generally man-made and refers to the excessive amount of noise in the surrounding which adversely affects people and animals.

Loud noise produced from vehicles, loud speakers, firecrackers, machinery, etc., can be harmful. It can cause hearing problems, sleep disorders, increase in heart beat rate, high blood pressure etc. Living near airports can be very harmful to the ears. Even loud music causes noise pollution.



Olympiad Bite

Noise level is measured in Decibel (dB). World Health Organisation (W.H.O.) has prescribed an optimum noise level as 45dB by day and 35dB by night. Any noise above 80dB is hazardous.

SELF TEST - 1

- Air pollution causes
(A) Acid rain (B) Deforestation
(C) Global warming (D) Both (A) and (C).
- Pollution cannot be prevented by
(A) Using bicycle to travel short distances
(B) Planting trees
(C) Recycling of paper
(D) Using plastic bags instead of jute bags.
- Which of the following will not cause soil pollution?
(A) A pen made of plastic
(B) Fruit peel
(C) Polythene bag
(D) Ceramic mug
- Select the odd one out.
(A) Malaria (B) Cholera
(C) Typhoid (D) Dysentery
- Which is not a greenhouse gas?
(A) Oxygen (B) Carbon dioxide
(C) Nitrous oxide (D) Methane

5.2 SAVING THE ENVIRONMENT

Conservation of our environment and its natural resources is one of our major responsibilities and a natural way of caring for self and for our future generations. The main focus is upon maintaining the health of the natural world.

Air Conservation

Various steps to reduce air pollution are:

- Closing industries which pollute the environment or shifting them to a place away from cities and heavily populated areas.
- Installing devices, like electrostatic precipitators, scrubbers, etc. in factories to reduce the release of polluting gases in the air.
- Using alternate fuels, like CNG (Compressed Natural Gas) for public transport vehicles and installing catalytic converters in automobiles to reduce vehicular exhaust.
- In India, owners of motor vehicles need to obtain Pollution Under Control (PUC) certificate at regular intervals to check emitted pollutants are not beyond the legal limits.
- Developing green belts of plants.

Water Conservation

Conservation of water means careful and economical use of water. Water crisis is a new major threat to the existence of millions of people around the world.

The purpose of water conservation is to make water easily available for a longer period of time. Some of the methods of water conservation are as follows:

- Dams and reservoirs should be constructed to collect water and avoid floods.

- Discharging waste water into the water bodies only after treatment
- Repair a leaking tap immediately and do not leave water running from taps while washing, brushing and bathing.
- More and more trees should be planted to prevent rain-water from flowing off.
- Rain water should be conserved and saved for future use.

Soil Conservation

Soil conservation refers to the protection of soil against pollution and erosion. This can be done in the following ways:

- After harvesting and before raising the next crop, farmers should grow cover crops such as grass and creepers to prevent soil erosion.
- Terrace farming reduces soil erosion. It is done in hilly areas. It consists of building a series of steps like benches. Steps slow down the flow of water. As the water flow slows down, some soil from one step is left on the next step, reducing the amount of soil lost.
- Afforestation or growing trees is another effective method of soil conservation.
- Celebrating Van Mahotsav festival in the first week of July by planting trees.
- Building embankments along river banks prevent floods. This holds the water between the banks and prevents soil erosion.
- Using bags of degradable materials, like paper and cloth instead of plastic bags.

SELF TEST - 2

1. Air pollution can be reduced by
(A) Discharging waste water only after treatment
(B) Using jute bags instead of plastic bags
(C) Installing catalytic converters in automobiles
(D) All of these.
2. When do we celebrate Van Mahotsav?
(A) In the first week of July
(B) On the first week of every month
(C) On Republic Day
(D) On first Sunday of every month

3. Soil erosion can be prevented by
(A) Deforestation (B) Terrace farming
(C) Overgrazing (D) Strong winds.
4. _____ along the river banks prevents soil erosion caused due to running water.
(A) Farming (B) Embankment
(C) Ploughing (D) Overgrazing
5. Select the odd one out.
(A) Newspaper (B) Wood
(C) Cloth (D) Plastic

5.3 NATURAL CALAMITIES

Natural calamities or disasters are events caused by nature that destroy human life and property. They can happen at any time or place. We have no control over them, but knowing them will help us take better care of ourselves when they occur. Earthquakes, cyclones, tsunamis, volcanoes and droughts are some examples of natural disasters.

Earthquakes

The sudden shaking or tremor of the Earth is called an **earthquake**.



A bridge and a house destroyed in an earthquake

It is caused by severe shock waves that travel through solid rocks from underground to the surface of the Earth. Earthquakes may be mild or massive. Massive earthquakes cause serious damage to life and property. Earthquakes can occur at any time, without any warning.

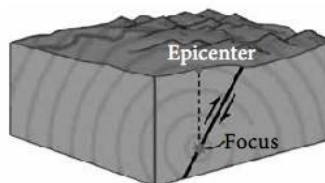
The Earth is made up of three layers- crust, mantle and core. **Crust** is the outermost layer of the Earth. The layer below the crust is known as **mantle** and made up of hot rocks. **Core** is the deepest or innermost layer of the Earth and it is made up of hot, molten material. Rocks present in the crust layer are in the form of large plates which keep on moving continuously and slowly past each other because of the movement of layers under the plates. Sometimes, these plates move apart and slide under each other with a lot of force. This, in turn, causes shakes and tremors to originate deep below the surface of the Earth and gradually reach the surface as an Earthquake.

The point under the ground where the earthquake begins is called **focus** and the corresponding spot on the surface is called **epicentre**. The instrument used to detect earthquakes is called a **seismograph** and scientists who study earthquakes are called **seismologists**.

Earthquakes are measured on the **Richter scale**.

Magnitude on Richter scale	Intensity of the earthquake	Damage caused
1-2	Cannot be felt by us	No damage
3-4	Felt slightly by us	No serious damage
5-6	Felt by us with high intensity	Serious damage
7-8	Felt with highest intensity	Massive damage

After a massive earthquake, smaller quakes or tremors may happen. These are called **aftershocks**. Aftershocks occur when the displaced plates of the Earth's crust fall back into place.



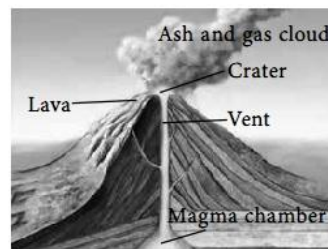
Focus and epicenter of the earthquake

Effects of an earthquake

- Huge structures like buildings, bridges, roads, dams, etc., get damaged or collapsed.
- Many people die and many others get injured in cause of severe earthquakes.
- People not only lose their homes, but also lose their clothes, utensils, food and everything.
- Electric poles, telephone wires and trees get uprooted. This affects communication and electricity supply.
- Drainage pipes breakdown resulting in scarcity of clean water and spread of diseases.
- Earthquakes can also cause floods, landslides and avalanches.

Volcanoes

A volcano is an opening on the Earth's crust, which allows hot, molten rock, ash and gases to escape. This hot molten rock is known as **magma**. Magma erupting from a volcano is called **lava**. Lava expelling during an eruption forms a cone-shaped mountain around the opening. Volcanoes are usually in the form of conical mountains.



Cone-shaped volcano

The magma comes up and collects in a chamber called **magma chamber**. When the pressure in this chamber builds up, the magma escapes out of the Earth through crack and opening in the Earth's crust called **vent**. The lava spreads over the land sometimes covering an entire region. It cools, solidifies and forms rocks. It takes a long time for lava to cool down. The hollow top of the volcanic mountain that is bowl shaped, is called **crater**. A crater can have more than one vent.

Based on the nature of eruption, volcanoes are of three types — active, dormant and extinct.

Active Volcanoes : A volcano that has erupted at least once in 10,000 years, e.g., Mt Etna, Mount Erebus.

Dormant Volcanoes : A volcano that has not erupted in recent years but may erupt in the future, e.g., Mauna Kea.

Extinct Volcanoes : A volcano that has not erupted in the last 10,000 years and is not expected to erupt in a comparable time scales, e.g., Mt Pope.

The Barren Island is an active volcano in the Andaman islands in India. It has been erupting from 1994.

Sometimes volcanoes are found under the sea. When the lava cools down, the area formed looks like a new island, called **oceanic islands**.

Effects of volcanic eruptions

- Poisonous gases released from volcanoes can cause breathing problems and can kill people.
- The hot molten lava flows very fast into the surrounding areas causing damage to property and life.
- An erupting volcano may trigger tsunamis, earthquakes, storms and rockfalls.

Cyclones/Hurricane/Typhoon

Cyclones are huge revolving storms that develop above seas and oceans. They are common in coastal areas and islands. Cyclones are characterised by strong winds and heavy rain. The speed of the wind causes a lot of damage.

Storms like these are called by different names in different places. For example, over the Bay of Bengal and the northern Indian Ocean, it is called a **cyclone**; in Japan, it is called a **typhoon**; while **hurricane** is the name given to tropical storms in the southern USA.



Cyclone

Floods

Floods may occur due to heavy rainfall, breaking of a dam, overflowing of river banks.

Effects of cyclones and floods

- Soil erosion
- Destruction of houses, bridges, roads, etc.
- Damage of crops and stored grains leading to shortage of food.
- Outbreak of diseases as water gets contaminated.
- Scarcity of clean drinking water.
- People and animals die due to drowning.
- Normal life gets disturbed. Communication and electricity supply get affected due to damage of telephone lines and electric poles.



Floods

Droughts and Forest Fires

Droughts occur due to lack of rain. The ground has no moisture. Streams and rivers dry up and no crop can survive. People die of famine, after a long period of drought, since there is an acute shortage of food.

A spark of lightning or the heat from the lava of a volcano can start a forest fire. These are some of the natural causes of a forest fire but it can also be caused by human carelessness.



Drought

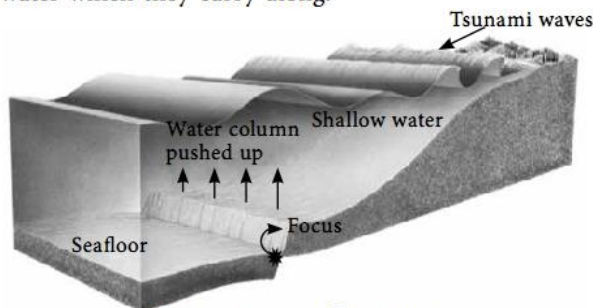
Tsunamis

Tsunamis are also called **tidal waves** or storm waves or giant waves. They are caused due to undersea earthquakes or volcanic eruptions due to which large volume of water gets displaced.



Huge water wave causes destruction

The waves caused due to underwater disturbance travel in all directions from the area of disturbance. As these waves approach the shallow water along the coast, they rise to a great height and crash over the shore. These waves have great energy because of large amounts of water which they carry along.



Tsunami waves formation

When a tsunami strikes a heavily populated coastline, the destruction is very serious. The effects of tsunami are also same as that of earthquakes or floods. When there is a tsunami, we should move away from coastal areas to higher places.

Disaster Management

After a disaster, people who survive will be under shock and trauma. They will be sad and depressed upon losing their families, relatives, friends and their homes and things. Many people might be having injuries and fractures.

Immediately after a disaster,

- Rubbles must be cleaned.
- People trapped under rubbles must be rescued.
- First aid should be given to injured people.
- Survivors must be consoled.

Some national and international organisations and charitable groups help the disaster victims by donating money, food items, utensils, clothes, beds, blankets etc. They also help the injured persons by donating blood and by offering services.

Some of these organisations are :

- NCC (National Cadet Corps)
- Red Cross Society
- World Health Organization (WHO)
- The United Nations Disaster Management Team (UNDMT)
- Child Relief and You (CRY)

There is a need for doctors, nurses, policemen, fire fighters, etc to tackle the situation after any disaster.



A rescue camp

In case, the disaster – affected areas are cut off from surrounding areas due to damage of roads, armed forces use helicopters to drop packets of food, water, clothes, medicines etc. Army also helps in constructing rescue camps for the victims.

Radio, television and newspapers provide information about disaster hit people and play an important role in finding the whereabouts of the victims and also the intensity of the situations.

SELF TEST - 3

1. City police conducted disaster management workshops for schools. Children were asked to run away from a particular natural disaster in a mock drill. Based on the picture, disaster may be a/an

- (A) Cyclone
- (B) Earthquake
- (C) Tsunami
- (D) Volcanic eruption.



2. What is the name given to the volcano that may erupt at any time or have erupted in recent past?

- (A) Active volcano
- (B) Extinct volcano
- (C) Dormant volcano
- (D) None of these

3. The water dashing against the coast is a

- (A) Shock wave
- (B) Tremor
- (C) Tidal wave
- (D) Both (A) and (C).



4. Which of the following disasters may not be triggered by an erupting volcano?

- (A) Earthquake
- (B) Tsunami
- (C) Drought
- (D) All of these

5. Select the odd one out.

- (A) Magma
- (B) Lava
- (C) Vent
- (D) None of these

EXERCISE

1. A list of few activities is given below.

Constructing dams, Terrace farming, Setting up new industrial area, Coal mining, Volcanic eruption, Deforestation.

How many of these activities can cause global warming?

- (A) 2 (B) 3 (C) 4 (D) 5

2. Earthquakes are measured by an instrument called

- (A) Richter scale (B) Seismogram
(C) Seismograph (D) None of these.

3. Air pollution can be reduced by the use of

- (A) Scrubber (B) Catalytic converter
(C) Electrostatic precipitator
(D) All of these.

4. It is an enormous wall of water that comes on to the shore in the form of waves and causes havoc in the coastal areas. The waves have a lot of force and they can cover long distance without losing power and energy. It is caused either by an earthquake on the ocean floor, or any other disturbance on the sea bed. The natural calamity being referred here is

- (A) Cyclone (B) Typhoon
(C) Drought (D) Tsunami.

5. Point in the Earth crust from where an earthquake begins is called _____.

- (A) Epicentre (B) Seismometer
(C) Focus (D) Tide.

6. Select the correct statement.

- (A) Increased UV rays cause acid rain.
(B) Increased CO₂ content in air causes global warming.
(C) Decreased carbon dioxide content of atmosphere can cause depletion of ozone layer.
(D) Increased oxygen content of atmosphere that causes rise in temperature of atmosphere.

7. Which of the following activities will not cause water pollution?

- (A) Washing clothes near lake.
(B) Increased use of pesticides and fertilisers.
(C) Treatment of sewage water before it is discharged into water bodies.
(D) Establishing more factories and industries.

8. World's largest active volcano is

- (A) Mauna Loa (B) Mount Vesuvius
(C) Mount Etna (D) Mount Erebus.

9. Embankments along riverbanks can reduce

- (A) Soil erosion (B) Floods
(C) Cyclones (D) Both (A) and (B).

10. Select the incorrect statements.

- (i) Subsequent tremors followed by massive earthquakes are called aftershocks.
(ii) Barren Island in India is a dormant volcano.
(iii) Earthquake is measured on the Vernier scale.
(iv) Breaking of dam can cause floods.
(A) (i) and (ii) only (B) (i), (iii) and (iv) only
(C) (ii) and (iv) only (D) (ii) and (iii) only

11. Which of the following statements are correct ?

- (i) Biodegradable house-hold wastes can increase soil fertility.
(ii) Planting of trees can help in preventing soil erosion.
(iii) Tidal waves are produced from hot water geysers.
(iv) Terrace farming helps in preventing soil erosion.
(A) (i), (ii) and (iv) only (B) (ii) and (iii) only
(C) (i), (ii) and (iii) only (D) (i), (ii), (iii) and (iv).

12. Select the option that on unscrambling give the name of hollow top of volcano that is shaped like a bowl.

- (A) GMAAM (B) RTACRE
(C) TEVN (D) RMTOER

13. Select the correct pair.

- (A) Cyclone - Northern Indian Ocean
(B) Typhoon - Bay of Bengal
(C) Hurricane - Japan
(D) Both (A) and (C)

14. _____ is the person who studies earthquakes.

- (A) Astronomer (B) Astrologer
(C) Geologist (D) Seismologist

15. Sumita was asked to write down few lines regarding a type of pollution. She wrote few lines as

- (i) It is caused when farmers use too much of pesticides.
(ii) Throwing away old plastic bottles also cause this type of pollution.
(iii) Poisonous waste from factories also cause this type of pollution.

Here, Sumita is referring to

- (A) Air pollution (B) Noise pollution
(C) Soil pollution (D) Both (A) and (C).

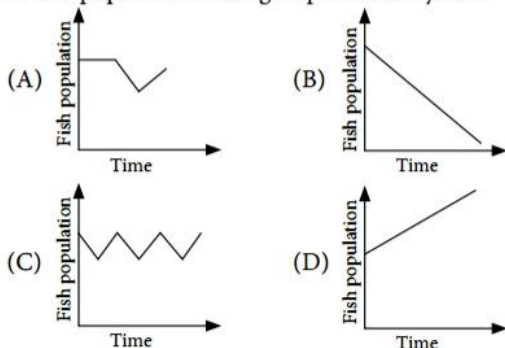
Achievers Section (HOTS)

16. Read the given statements and select the option that correctly fills the blanks in any two of them.

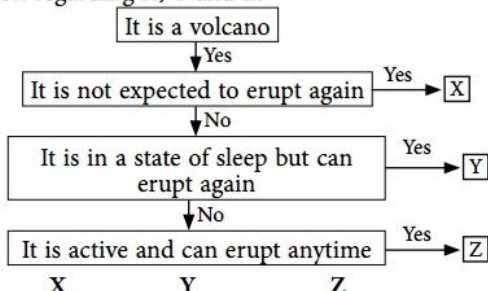
- (i) _____ is not a greenhouse gas.
(ii) _____ protocol is an agreement signed by many countries to reduce greenhouse gases.

- (iii) Any noise above _____ dB is hazardous.
 (iv) _____ helps to reduce air pollution from factories.
 (A) (i) Carbon dioxide (ii) Kyoto
 (B) (i) Oxygen (iii) 80
 (C) (ii) Montreal (iv) Catalytic converter
 (D) (iii) 45 (iv) Scrubber

17. A river flowing through a village is supporting a large number of fish population. But later, few farmers started doing agricultural practices along its bank. Which of the following graphs correctly represents the changes in fish population during a span of few years?

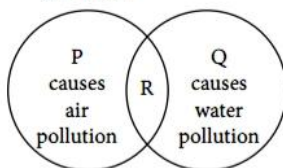


18. Refer to the given flow chart and select the correct option regarding X, Y and Z.



- (A) Mauna Kea Mt Etna Mt Pope
 (B) Mt Etna Mauna Kea Mt Pope
 (C) Mt Pope Mauna Kea Mt Etna
 (D) Mauna Kea Mt Pope Mt Etna

19. Refer to the given Venn diagram and select the incorrect option regarding P, Q and R.



- (A) P could be an activity that is caused due to the production of smoke from vehicles.
 (B) Q could be an activity that is caused due to spilling of oil or petroleum into rivers.
 (C) Industrial units engaged in manufacturing of a particular item could cause R.
 (D) None of these.

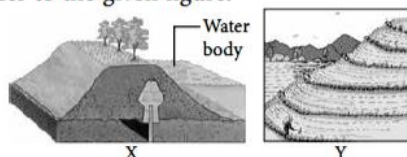
20. Read the given statements and select the option that correctly states them as true (T) and false (F) ones.

- (i) Drinking contaminated water could cause malaria.
 (ii) Metal cans and ceramic cups are non-biodegradable.
 (iii) Fertilisers and pesticides cause water and soil pollution.
 (iv) Acid rain is harmful for both terrestrial and aquatic life.

- | | (i) | (ii) | (iii) | (iv) |
|-----|-----|------|-------|------|
| (A) | F | F | T | T |
| (B) | T | F | T | F |
| (C) | F | T | T | T |
| (D) | T | F | F | T |

SOF NSO 2018 QUESTIONS

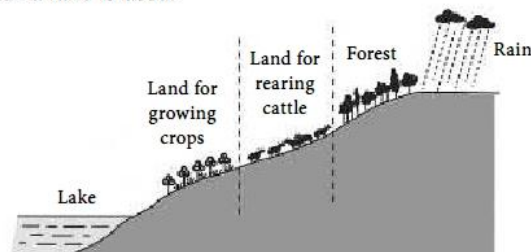
1. Refer to the given figure.



Which of the following is correct regarding X and Y?

- (A) X is a method of reducing soil erosion by wind only whereas Y is a method of reducing soil erosion by water only.
 (B) Both X and Y are practised only in mountainous regions.
 (C) X represents embankment whereas Y represents step farming.
 (D) None of these (Level-1)

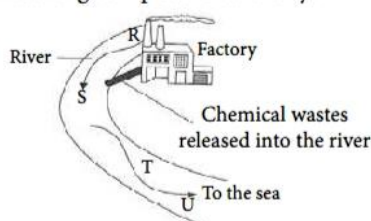
2. Study the given diagram that shows how some land near a lake is used.



Which of the following is most likely to cause the lake to flood?

- (A) Cutting down the forest
 (B) Removing the cattle
 (C) Using pesticides on the crops
 (D) Growing crops (Level-1)

3. Look at the given picture carefully.



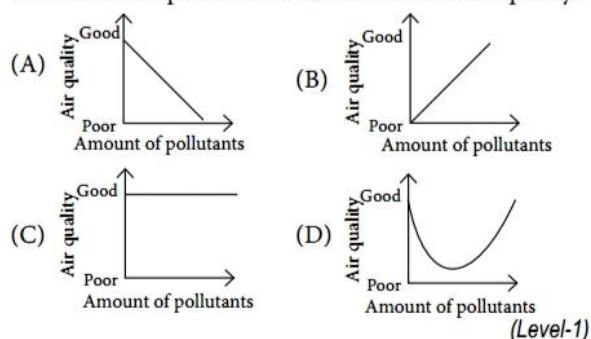
Some local residents wanted to collect water from the river for consumption at home. From which part of the river, R, S, T or U, will the water be safest to consume?

- (A) R (B) S
(C) T (D) U (Level-1)

4. Which of the following are the effects of global warming?

- (i) Drowning of coastal areas
(ii) Cyclones becoming more frequent
(iii) Droughts becoming more intense
(iv) Shrinking of the Arctic ice
(A) (i), (ii) and (iv) only (B) (i) and (iii) only
(C) (ii) and (iv) only (D) (i), (ii), (iii) and (iv) (Level-1)

5. Which graph best represents the relationship between the amount of pollutants in the air and the air quality?



6. Which of the following is not responsible for soil erosion?

- (A) Afforestation (B) Floods
(C) Overgrazing (D) Strong wind (Level-1)

7. Ali studied two groups of things as shown in the given table.

Biodegradable	Non-biodegradable
Fruit peel	Gold chain
Meat	Polybag
Dairy products	Aluminium can

He made the following inferences. Which one of the inferences is correct?

- (A) All non-biodegradable objects are hard.
(B) All living things are non-biodegradable.
(C) Biodegradable objects come only from animals.
(D) Most things obtained from living organisms are biodegradable. (Level-1)

8. Which of the following activities will cause both air and noise pollution?

- (A) Explosion of crackers
(B) A passenger plane taking off on runway
(C) A group of students shouting in the class
(D) Both (A) and (B) (Level-1)

9. Select the incorrect statement regarding water pollution.

- (A) Suspended impurities make water less transparent causing death of submerged aquatic plants.
(B) Polluted water can cause diseases like typhoid, cholera and diabetes.
(C) Pollution decreases dissolved oxygen content of water.
(D) Agricultural runoff pollutes water by adding pesticides and fertilisers into it. (Level-2)

10. Nowadays, CNG is used as a substitute for petrol and diesel. It is a more environment friendly and cleaner alternative to conventional fuels. Which of the following statements is incorrect for CNG?

- (A) CNG is low in pollutants.
(B) CNG is economical and available in abundance globally.
(C) CNG is made by compressing natural gas to less than 1% of its volume at standard atmospheric pressure.
(D) None of these (Level-2)

11. 'Reducing', a part of garbage management can be exemplified by _____.

- (A) Carrying your own jute bag while shopping
(B) Packing objects using least possible packing material
(C) Using both sides of paper for writing
(D) All of these (Level-2)

12. Read the given statements and select the correct option.

Statement 1 : Greenhouse gases in the atmosphere trap the heat of the Sun and increase the temperature of the Earth.

Statement 2 : CO₂, nitrous oxide, methane and water vapour are greenhouse gases.

- (A) Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
(B) Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
(C) Statement 1 is true but statement 2 is false.
(D) Both statements 1 and 2 are false. (Level-2)

13. Unscramble the letters given in column II to make meaningful terms and match column I with column II to select the correct option.

Column I	Column II
P. Tropical storm with spinning winds	(i) RACERT
Q. Hollow top of the volcano	(ii) UGHORDT
R. Extended period of dry weather	(iii) ELOCYNC
S. Magma erupting from a volcano	(iv) ALAV

- (A) P - (i); Q - (iii); R - (ii); S - (iv)
(B) P - (iv); Q - (ii); R - (i); S - (iii)
(C) P - (i); Q - (iii); R - (iv); S - (ii)
(D) P - (iii); Q - (i); R - (ii); S - (iv) (Level-2)

HINTS & EXPLANATIONS

SELF TEST - 1

1. (D): Deforestation is one of the main cause of air pollution.
2. (D): Pollution can be prevented by using jute bags instead of plastic bags.
3. (B): Fruit peel is an example of biodegradable waste and it decomposes in harmless substances over time. Plastic pen, polythene bag and ceramic mug are non-biodegradable wastes and thus cause soil pollution.
4. (A): Malaria is a protozoan disease and is mainly caused due to mosquito bite. Cholera, typhoid and dysentery are bacterial diseases and are caused due to drinking of impure water.
5. (A)

SELF TEST - 2

1. (C): Discharging waste water after treatment reduces water pollution and using jute bags decrease soil pollution.
2. (A)
3. (B): Terrace farming is done in hilly areas to reduce soil erosion. It consists of building a series of steps like benches and the steps slow down the flow of water.
4. (B)
5. (D): Plastic is an example of non-biodegradable waste whereas newspaper, wood and cloth are biodegradable wastes.

SELF TEST - 3

1. (B)
2. (A): Active volcanoes can erupt anytime or has erupted in recent years. *e.g.*, Mt Etna.
3. (C): Tidal wave or tsunami is an enormous wall of water that comes on the coast in the form of waves and causes destruction in coastal areas.
4. (C)
5. (D): Magma, lava and vent are the terms related to volcano.

EXERCISE

1. (B): Setting up new industrial area, volcanic eruption and deforestation can cause global warming. Setting up new industrial area will result into the release of harmful gases. Volcanic eruption releases poisonous gases and

deforestation will increase the concentration of CO_2 in the environment which leads to global warming.

2. (C)
 3. (D): Electrostatic precipitators and scrubbers can be installed in factories to reduce the release of harmful gases in the air. Catalytic converters can be installed in automobiles to reduce vehicular exhausts.
 4. (D)
 5. (C): The point under the Earth's crust where the earthquake begins is called focus and the corresponding spot on the surface is called epicentre.
 6. (B): Carbon dioxide is a greenhouse gas. Increased concentration of carbon dioxide results in the rise in temperature and ultimately leads to global warming.
 7. (C)
 8. (A): Hawaii's Mauna Loa is the world's largest active volcano.
 9. (D): Embankments hold the water between the banks and prevent soil erosion and flood.
 10. (D): Barren Island in India is an active volcano. Earthquakes are measured on the Richter scale.
 11. (A): Tidal waves are caused by an undersea earthquake or by a severe hurricane or cyclone.
 12. (B): The options (A), (B), (C) and (D) on unscrambling give magma, crater, vent and tremor respectively.
- The hollow top of the volcano that is shaped like a bowl is called a crater.

13. (A): Strong storm with fast spinning winds are called by different names in different places. It is called cyclone over the Bay of Bengal and the northern Indian ocean and a typhoon in Japan. Hurricane is the name given to tropical storms in the southern USA.

14. (D) 15. (C)

16. (B): Oxygen is not a greenhouse gas. Kyoto protocol is an agreement signed by many countries to reduce greenhouse gases. Any noise above 80 dB is hazardous. Scrubber helps to reduce air pollution from factories.

17. (B): The agricultural practices along the bank of the river pollutes the river by the release of agricultural wastes. This in turn decreases the fish population. So, the fish population will decrease overtime.

18. (C) : In the given flow chart, X, Y and Z refers to extinct, dormant and active volcano respectively. Mt Pope, Mauna Kea and Mt Etna are examples of extinct, dormant and active volcanoes respectively.

19. (D) : In the given Venn diagram, P refers to the activity that causes air pollution and Q refers to the activity that causes water pollution. R refers to the activity that causes both air and water pollution.

20. (C) : Malaria is generally caused by mosquito bite. It is not a water-borne disease.

SOF NSO 2018 QUESTIONS

1. (C)

2. (A) : Trees bind the soil with their roots. When forests are cut down, the soil gets easily washed away with rainwater. This rainwater along with top soil will reach the lake and cause its flooding.

3. (A) : Chemical wastes released by the factory at S point into the river. So, the river water gets contaminated from the S part. The polluted water further flows into T and U part. It will be safest to consume water from R part as the water is not contaminated at this point.

4. (D)

5. (A) : Increase in the amount of pollutants will decrease the air quality overtime.

6. (A) : Afforestation or planting trees is an effective method of soil conservation.

7. (D) : Wastes which decomposes overtime known as biodegradable waste and wastes which cannot be broken down over a long period of time is known as non-biodegradable waste. Most things obtained from living organisms like cow dung, dairy products, etc. are biodegradable.

8. (D)

9. (B) : Polluted water can cause disease like cholera, typhoid, dysentery, etc. Diabetes is not caused by water pollution.

10. (D) 11. (D)

12. (B) : The increase in the concentration of greenhouse gases in the atmosphere leads to an increase in the temperature on Earth.

13. (D)



Earth and Universe

Learning objectives

6.1 The solar system

6.4 Eclipses

6.2 Earth and its movements

6.5 Artificial satellites

6.3 Moon and its phases

6.6 Space travel

There are many amazing things present in the sky. During the daytime, we see the Sun. At night we see the Moon and stars. Sun is also a star. It is one star among the billions in the milky way galaxy. The sky also has planets and satellites. These natural bodies in the space are known as **celestial bodies**. They are very huge but they appear small as they are very far away from us.

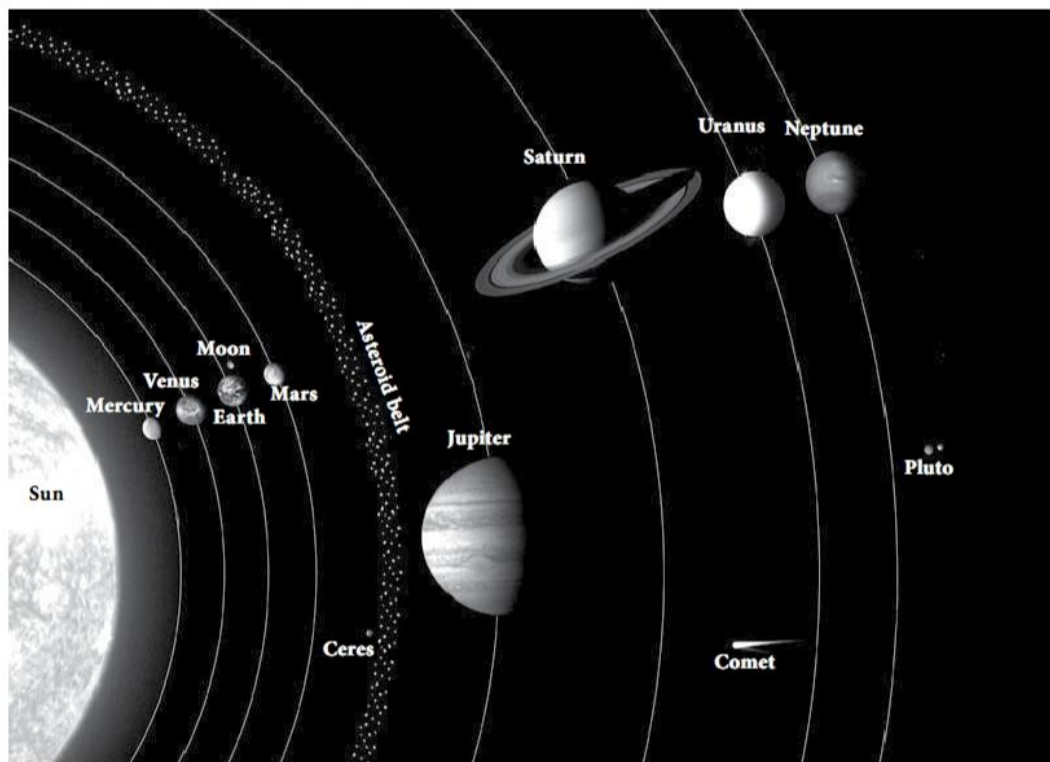
6.1 THE SOLAR SYSTEM

Our solar system consists of the Sun and other celestial bodies that **revolve** around it. Apart from planets, natural satellites, asteroids, comets and dwarf planets are a part of our solar system.

The Planets

All planets revolve around the Sun in fixed paths called **orbits**. Planets also **rotate** or spin about their own axis. They do not give out light of their own. They only reflect the light of the Sun.

Eight planets of our solar system in order of their increasing distance from the Sun are Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. All planets except Venus and Uranus rotate from west to East (anticlockwise). Venus and Uranus rotate from East to West (clockwise).



The solar system

Features of inner planets (Made up of rocks)

Mercury (<i>Budh</i>)	Venus (<i>Shukra</i>)	Earth (<i>Prithvi</i>)	Mars (<i>Mangal</i>)
➤ Smallest planet ➤ Closest planet to the Sun. ➤ It takes 88 days to revolve. ➤ It does not have any satellite.	➤ Hottest planet ➤ It shines brightly and so, it is called the morning and evening star. ➤ It takes 224 days to revolve. ➤ It does not have any satellite.	➤ Only planet where life exists. ➤ 70 percent of its surface is covered with water, so known as blue planet ➤ It takes 365 days to revolve. ➤ The moon is its only natural satellite.	➤ Red planet ➤ It has a lot of rusted iron dust which makes it appear red. ➤ Its atmosphere contains lot of carbon dioxide and small amount of oxygen and water vapour. ➤ It takes 687 days to revolve. ➤ It has 2 moons.

Features of outer planets (Made up of gases)

Jupiter (<i>Brihaspati</i>)	Saturn (<i>Shani</i>)	Uranus (<i>Arun</i>)	Neptune (<i>Varun</i>)
➤ Largest planet ➤ Mainly made up of hydrogen and helium ➤ It does not have solid surface, but is said to have a solid core. ➤ It has rings of dust around it. ➤ It takes 12 years to revolve. ➤ It has more than 60 moons.	➤ Second largest planet ➤ It is made up of gases and has prominent rings of ice and rocks around it. ➤ It takes 30 years to revolve. ➤ It has 62 moons.	➤ Coldest planet ➤ It is made up of gases and ice. ➤ It has blue colour due to presence of methane gas in atmosphere. ➤ It has faint rings around it. ➤ It takes 84 years to revolve. ➤ It has 27 moons.	➤ Farthest planet ➤ It is composed of gases and ice of water, ammonia and methane. ➤ It has faint rings around it. ➤ It takes 165 years to revolve. ➤ It has 13 moons.



Olympiad Bite

Pluto was earlier considered as a planet but in August 2006 International Astronomical Union placed it into a separate category called as dwarf planet. Other dwarf planets of our solar system are Ceres, Eris, Haumea and Makemake.

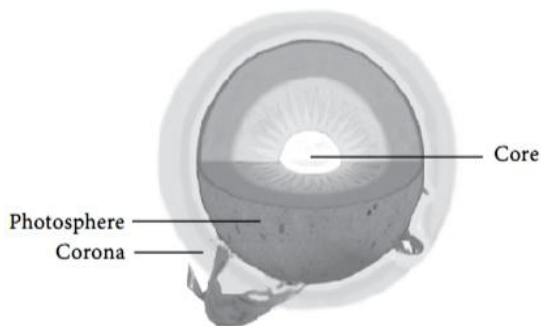
The Sun

The Sun is a big ball of hot, burning gases held together by gravity. It is made up mostly of hydrogen. Hydrogen is continuously changing to helium by a process called **nuclear fusion**. It results in emission of huge amounts of energy in the form of light and heat. This energy is known as **solar energy**. It is the main source of energy for the entire solar system. The Sun is 150 million kilometres away from the Earth. The gravity of the Sun keeps all the planets lined up in their orbits. The diameter of the Sun is about 13,92,000 km. The Sun has various layers:

- **Corona** is the thick layer of gases which forms the outer part of Sun's atmosphere. It extends for

millions of kilometres around the Sun in the space. Temperature of this layer can reach upto 2 million °C which is much hotter than the Sun's surface. It can be seen during a total solar eclipse.

- **Photosphere** is the visible surface of the Sun which gives off light. It takes 8 minutes 20 seconds for this light to reach the Earth. Here, the temperature is around 5,500 °C.
- **Core** is the center of the Sun, where nuclear fusion takes place. Here the temperature is around 15,00,000 °C.



Internal structure of Sun

Stars and Constellations

The tiny specs of light that appear in the night sky are called **stars**. They shine and glow in the sky and spread their heat and light in space. They are actually very huge but they appear tiny as they are far away from

us. **Constellations** are the specific patterns formed by group of stars in the sky. Some constellations are Ursa Major (The Great Bear), Ursa Minor (The Little Bear), Orion (The Hunter), Scorpius (Scorpion), Cassiopeia etc.



Ursa major



Orion



Scorpius



Ursa minor



Cassiopeia

Asteroids and Comets

Asteroids are the small rocky objects that orbit the Sun. **Asteroid belt** is present between Mars and Jupiter. A comet is a big ball of rocks, ice and dust. They are found travelling throughout space. When it comes close to the Sun, the particles in the comet heat up and start spewing dust and gas. This debris produces a visible tail.



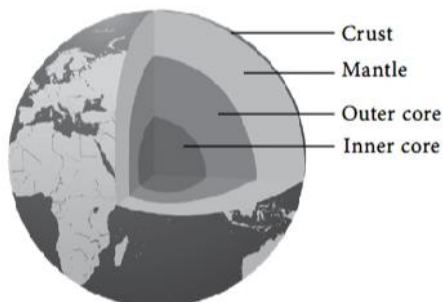
Comet

6.2 EARTH AND ITS MOVEMENTS

Earth is the third planet from the Sun in our solar system. It is the only planet of our solar system where life exists. The blanket of air that surrounds the Earth is known as **atmosphere**. It protects us from harmful ultra violet rays of the Sun. Presence of atmosphere, water and soil makes the Earth hospitable for living.

Internal Structure of the Earth

Earth is approximately 4.5 billion years old and is spherical in shape. It is made up of crust, mantle and the core. Core is further divided into outer core and inner core.



Internal structure of the Earth

Crust

- It is the outermost layer of the Earth.
- It is rocky and is broken into many pieces called **plates**.
- Crust forms continents (or land mass) and oceanic floors.
- Oceanic crust is very dense and made up of basalt, whereas continental crust is less dense and made up of granite.
- It is 5-7 km thick under the ocean floor and 10-70 km thick under the continents.

Mantle

- This layer is below the crust.
- It is the **thickest layer** of the Earth.
- It extends to a depth of 2900 km.
- Its upper part is made of solid rocks, while lower part consists of molten rocks (magma).
- The molten rocks or magma comes out on the crust when a volcano erupts.
- It is composed of iron, magnesium, aluminium, silicon and silicate compounds.

Outer core

- Core forms the centre of the Earth. The outer core is so hot that it is in a molten state, however it is denser than the mantle.
- The outer core contains iron and nickel with some sulphur also. It is about 2200 km thick.

Inner core

- The inner core is under such an extreme pressure that despite of the hottest temperature there, it remains solid and is rich in iron. It is about 1200 km thick.



Olympiad Bite

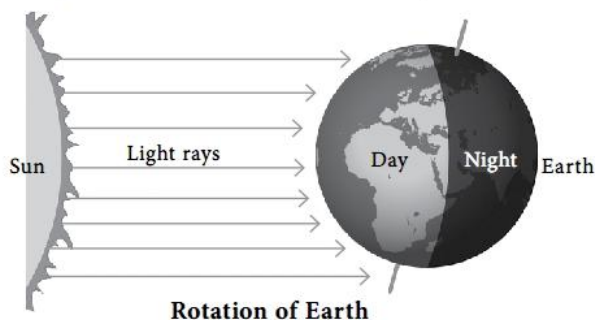
- Earth is able to hold the layer of atmosphere by the force of gravity.
- Compass is a direction telling device which works with the help of Earth's magnetic field. It has a magnetised needle that under the effect of Earth's magnetic field always points towards the north direction.

Movements of Earth

Earth is moving all the time. Two kinds of movements shown by Earth are rotation and revolution.

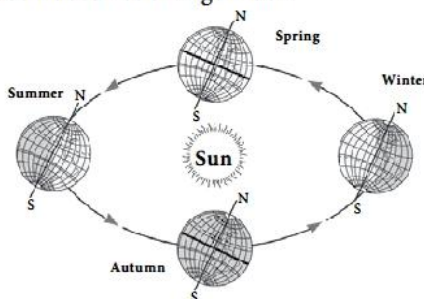
Rotation

The spinning movement of the Earth on its axis is called **rotation**. **Axis** is an imaginary line running from North pole to the South pole. Earth rotates from West to East and its axis is slightly tilted at an angle of 23.5° . Rotation of Earth causes days and nights. One complete rotation causes one day and one night. Earth completes one rotation on its axis every 24 hours.



Revolution

The movement of Earth around the Sun in a fixed path or orbit is called **revolution**. Earth takes approximately 365 days or 1 year to complete one revolution. The revolution of the Earth and its tilt on its axis causes changes in the season during a year. The imaginary line around the Earth that divides the Earth into two equal halves, i.e., Northern hemisphere and Southern hemisphere is called **equator**. As the Earth moves around the Sun, the tilt causes the Sun's rays to fall more directly on either the Northern hemisphere or the Southern hemisphere, depending upon the position of the Earth. The half that receives more sunshine has summer, whereas the other half has winter. About six months later, the situation changes, and the half that had summer now has winter, and the half that had winter, now has summer. India is in the northern hemisphere, whereas Australia is in the southern hemisphere. This is why when it is winter in India, Australia has summer. The equator receives direct sunlight throughout the year hence, on equator, the season does not change much.



Changes in seasons in Northern hemisphere

SELF TEST - 1

- Earth is able to hold a layer of atmosphere around it by a force of
 - Friction
 - Electromagnetic waves
 - Gravity
 - All of these.
- Which planet is also known as morning and evening star?
 - Mercury
 - Neptune
 - Mars
 - Venus
- What is the name of constellation shown in the given figure?
 - Ursa Major
 - Cassiopeia
 - Orion
 - Scorpius



- Select the incorrect statement.
 - Outermost layer of Earth is made up of rocks.
 - Mantle is rich in iron, magnesium and silicates.
 - Outer core of Earth is rich in iron whereas inner core is rich in nickel.
 - Outer core is in liquid state whereas inner core is in solid state.
- The Sun is mostly made up of _____, which is continuously changing to _____ by nuclear fusion.
 - Hydrogen, helium
 - Helium, hydrogen
 - Hydrogen, oxygen
 - Oxygen, helium

6.3 MOON AND ITS PHASES

Moon is the natural satellite of Earth. It is our closest neighbour in space. **Satellite** is an object that revolves around a planet. Therefore, as Earth revolves around the Sun, Moon revolves around the Earth. It is 3,84,400 km away from the Earth.

Characteristic Features of Moon

Moon is a ball of rocks about $\frac{1}{4}$ th the size of Earth. It does not have its own light, it shines as it reflects the light of Sun. Moon appears uneven to the naked eyes as it has mountains and huge round depressions called **craters**. Its crust is covered with a thick layer of dust. Moon does not have an atmosphere so it becomes very hot (127°C) during the day and freezing cold (-173°C) during night. Water and air are not present on Moon. As no air is there, therefore no sound can be heard there. Moon pulls everything towards its centre due to its force of gravity, although its gravity is $\frac{1}{6}$ th of the Earth's gravity.

Phases of Moon

As the Moon revolves around the Earth, its lighted part changes. These changing shapes of the Moon are called **phases of the Moon**. They can be seen in the night sky. When the Moon is not visible at all it is called **New Moon**. When a very small portion of the Moon is visible, it is called **Crescent Moon**. When half side of the Moon is visible it is called **Half Moon**. When about three-quarter of the Moon is visible, it is called **Gibbous Moon**. When one side of the Moon is totally visible, it is called **Full Moon**.

The Moon's revolution around the Earth is also called **lunar cycle**. In the first half of the cycle, the size of lighted part of the Moon increases from New Moon to Full Moon. This is called **waxing phase**. In the second half of cycle, the size of lighted part of the Moon decreases from Full Moon to New Moon. This is called **waning phase**. This completes a lunar cycle (New Moon to New Moon). It takes about 28 days to complete one human cycle.



Phases of Moon

Moon and the Tides

Moon's gravity is weak, even then it has a noticeable effect on Earth. It causes **tides** by pulling the water of seas and oceans. High tides are caused when water of seas and oceans, on side of the Earth facing the Moon is attracted upwards. In areas between two high tides water forms low tides. The highest tides occur at the time of the New Moon and the Full Moon.

Man's Landing on Moon

Man first time successfully landed on the Moon on 20th July 1969 in American spacecraft Apollo 11. The spacecraft carried three American astronauts, Neil Armstrong, Edwin Aldrin and Michael Collins. Neil Armstrong and Edwin Aldrin stepped on the Moon's surface, while the third astronaut, Michael Collins, remained in the spacecraft to circle the Moon and keep in touch with the Earth.



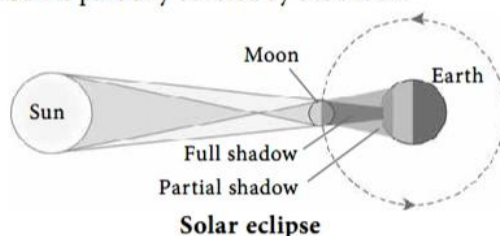
Neil Armstrong | Michael Collins | Edwin Aldrin
Astronauts of Apollo 11

6.4 ECLIPSES

Eclipse occurs when the Sun, the Earth and the Moon come in a straight line, and either Earth or Moon casts a shadow on the other. Two types of eclipses that are observed from Earth are solar and lunar eclipse.

Solar Eclipse

A solar eclipse occurs when the Moon comes between the Sun and the Earth. The Moon casts shadow on the Earth. The solar eclipse can be seen only from that part on the Earth where the shadow falls. Total solar eclipse occurs when the Moon covers the Sun completely. The total eclipse is rare. Partial solar eclipse occurs when the Sun is partially covered by the Moon.

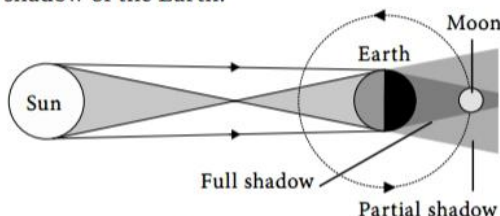


Lunar Eclipse

The Moon constantly revolves around the Earth. At times during this journey, the Moon moves into the

dark shadow of the Earth and does not receive any sunlight. Then it gets hidden from view. This is called as **lunar eclipse**.

Total lunar eclipse occurs when the Moon is completely covered by the dark shadow of the Earth. Partial lunar eclipse occurs when the Moon is only partly hidden by the shadow of the Earth.



Lunar eclipse

6.5 ARTIFICIAL SATELLITES

Artificial satellites are man-made objects that revolve around the Earth. Sputnik-I was the world's first artificial satellite. Currently about 4987 satellites revolve around the Earth. A rocket is used to launch an artificial satellite into space. Artificial satellites help in communication, weather forecasting, defence, navigation and research. **Aryabhata**, launched in 1975 was the first Indian satellite. Bhaskara, Rohini, Apple, Insat 1A, Insat 1B, Insat 1C, Insat 1D, Insat 2A, Insat

2B, Insat 2C, Insat 3B, Insat 3C, Insat 3A and Insat 3E are some other Indian satellites.

6.6 SPACE TRAVEL

Rakesh Sharma, Kalpana Chawla and Sunita Williams are Indians to go into the space. Rakesh Sharma was the first Indian to go into the space. Kalpana Chawla was the first Indian woman to go into the space. Astronauts go to space in spacecrafts carried by rockets. Since there is no air in space, the astronauts have to wear spacesuits. Actually these suits create a small atmosphere around their bodies. These special suits enable them to float. Astronauts have to do different jobs. Some do experiments, some work inside the shuttle, some do repair outside the spacecraft. Some even fix satellites. When the mission is over, the astronauts come back in space shuttles. The shuttles can be used again and again but rockets can be used only once.



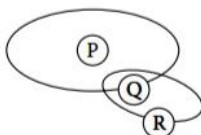
Olympiad Bite

- Space age began in 1957. On 12th April 1961, Yuri Gagarin (of Russia) became first man in the world to go into space.
- Valentina Tereshkova is the first woman to go into space.

SELF TEST - 2

1. Refer to the given figure.

If Q represents Earth, then P and R represent _____ and _____ respectively.



- | P | Q |
|-----------|-------|
| (A) Sun | Venus |
| (B) Sun | Moon |
| (C) Ceres | Moon |
| (D) Moon | Sun |

2. Moon's gravity is _____ of Earth's gravity.

- | | |
|----------------|---------------|
| (A) One-fourth | (B) Equal |
| (C) One-tenth | (D) One-sixth |

3. Match column I with column II and select the correct option from the given codes.

Column I	Column II
P. New Moon	(i) Small part of Moon is lighted
Q. Crescent Moon	(ii) Three-fourth of Moon is lighted
R. Half Moon	(iii) Moon is between Sun and Earth
S. Gibbous Moon	(iv) One entire side of Moon is lighted

T. Full Moon (v) Half side of Moon is lighted

- | |
|---|
| (A) P-(iii); Q-(ii); R-(v); S-(i); T-(iv) |
| (B) P-(iv); Q-(i); R-(v); S-(ii); T-(iii) |
| (C) P-(iii); Q-(i); R-(v); S-(ii); T-(iv) |
| (D) P-(iv); Q-(ii); R-(v); S-(i); T-(iii) |

4. _____ are man-made objects that revolve around the Earth.

- | |
|---------------------------|
| (A) Moons |
| (B) Natural satellites |
| (C) Artificial satellites |
| (D) None of these |

5. Select the correct statement.

- | |
|---|
| (A) Michael Collins was the first person to step on the Moon. |
| (B) Moon's gravitational pull is responsible for high tides and low tides on Earth. |
| (C) Sunita Williams was a woman of American origin to go into the space. |
| (D) Artificial satellite is used for communication while natural satellite is used for weather forecasting. |

EXERCISE

1. Select the option which on unscrambling gives the name of constellation shown in the figure.



- (A) CUOISPRS
- (B) RIONO
- (C) ACPSIOSIAE
- (D) None of these

2. Refer to the given statements about a planet.

- (i) It shines brightly in the sky.
- (ii) It takes around 224 days to revolve around the Sun.
- (iii) It does not have any natural satellite.

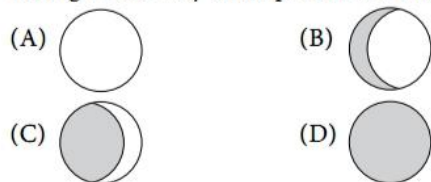
Select the option which identifies the planet correctly.

- (A) Mercury
- (B) Mars
- (C) Venus
- (D) Saturn

3. Select the incorrect statement.

- (A) Earth crust forms continents and oceanic floors.
- (B) Upper part of mantle is made up of solid rocks.
- (C) Outer core contains iron, nickel with some sulphur also.
- (D) The iron rich inner core is in liquid state.

4. Which of the following shows the phase of the Moon during which very small part of it is illuminated?



5. Select the odd one out.

- (A) Venus
- (B) Uranus
- (C) Earth
- (D) Mercury

6. Match column I with column II and select the correct option from the given codes.

- | | |
|------------|----------------------------|
| P. Uranus | (i) Red planet |
| Q. Mars | (ii) Second largest planet |
| R. Mercury | (iii) Coldest planet |
| S. Saturn | (iv) Smallest planet |

- (A) P-(iv), Q-(iii), R-(ii), S-(i)
- (B) P-(iii), Q-(iv), R-(i), S-(ii)
- (C) P-(ii), Q-(i), R-(iv), S-(iii)
- (D) P-(iii), Q-(i), R-(iv), S-(ii)

7. Complete the given analogy and select the correct option.

Budh : Mercury :: Arun : _____

- (A) Jupiter
- (B) Mars
- (C) Saturn
- (D) Uranus

8. When the natural satellite of the Earth is completely in the dark shadow of the Earth, _____ occurs.

- (A) Partial solar eclipse
- (B) Total solar eclipse
- (C) Partial lunar eclipse
- (D) Total lunar eclipse

9. In reality, Moon

- (A) Changes its shape everyday
- (B) Does not revolve round the Earth everyday
- (C) Is differently illuminated on the side facing the Earth
- (D) Grows or reduces in size frequently.

10. When the Moon starts reducing from Full Moon to New Moon, it is the _____ phase of it.

- (A) Waxing
- (B) Waning
- (C) Gibbous
- (D) Crescent

11. The Sun, the Moon and the Earth are in a straight line and the Moon comes in between the Sun and the Earth. This is known as

- (A) Lunar eclipse
- (B) Solar eclipse
- (C) Gibbous Moon
- (D) Full Moon.

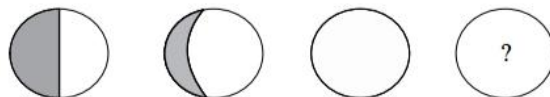
12. Which of the following on unscrambling gives the name of the visible surface of the Sun that gives off light?

- (A) EROC
- (B) EPSHOOTHERP
- (C) OTAMPESHER
- (D) RNCOOA

13. Artificial satellites do not help in

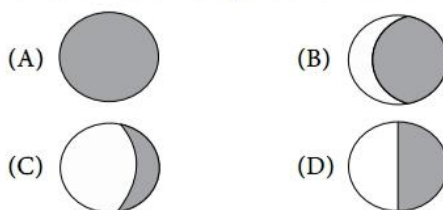
- (A) Communication
- (B) Weather forecasting
- (C) Navigation
- (D) Causing high tides.

14. Raghu observed different phases of Moon on the following dates.



December 21 December 25 December 28 December 31

What will be the shape of the Moon on December 31?



15. Read the given passage.

The spinning movement of the Earth on its axis is called ____ (i) _____. ____ (ii) _____ is an imaginary line running from North pole to the South pole of Earth. Earth is slightly tilted at an angle of ____ (iii) _____. Rotation of Earth causes days and nights. One complete rotation causes one day and one night. Earth completes one rotation on its axis in about ____ (iv) _____.

- | | (i) | (ii) | (iii) | (iv) |
|-----|------------|---------|-------|----------|
| (A) | Rotation | Axis | 23.5° | 24 hours |
| (B) | Rotation | Axis | 25.3° | 365 days |
| (C) | Revolution | Equator | 23.5° | 24 hours |
| (D) | Revolution | Axis | 25.3° | 365 days |

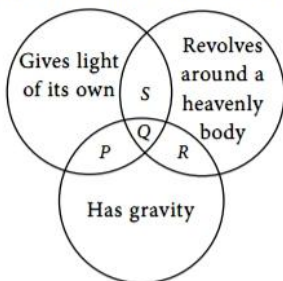
Achievers Section (HOTS)

16. Read the given statements and select the option that correctly states them as true (T) and false (F) ones.

- Man first time landed successfully on Moon on 21st July 1965.
- Yuri Gagarin is the first man in the world to go into the space.
- Rakesh Sharma is the first Indian to go into the space.
- Kalpana Chawla was the first woman to go into the space.

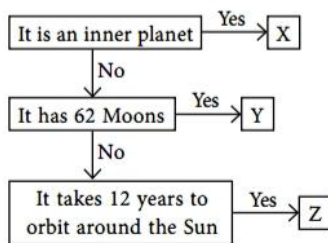
- | | (i) | (ii) | (iii) | (iv) |
|-----|-----|------|-------|------|
| (A) | F | F | T | T |
| (B) | T | T | F | F |
| (C) | F | T | T | F |
| (D) | T | F | T | F |

17. Refer to the given Venn diagram and select the option which identifies Sun and Earth correctly.



- | Sun | Earth |
|-------|-------|
| (A) P | R |
| (B) Q | R |
| (C) P | S |
| (D) R | S |

18. Refer to the given flow chart and select the correct option regarding X, Y and Z.



- X could be a planet that is called as morning and evening star.
- Y could be a planet that has prominent rings of ice and rocks around it.
- Z could be the largest planet of our solar system.
- All of these

19. Which of the following is not present in the given word grid?

P	I	H	J	B	P	Z	R	T	K
A	K	M	K	C	C	S	M	C	S
G	M	R	C	T	Q	L	O	Q	R
T	A	Y	R	J	O	M	K	C	N
N	P	M	A	N	T	L	E	K	M
T	K	O	T	R	E	B	T	P	C
R	C	L	E	P	H	V	S	O	V
R	G	O	R	B	I	T	T	C	X
S	Q	Y	U	H	E	X	R	B	T
V	B	N	H	J	R	N	Z	L	Y

- Circular path in which planets revolve.
- Middle layer of Earth.
- A phenomena caused due to gravity of Moon.
- Huge pits on the surface of Moon

20. Read the given statements and select the option that correctly fills the blanks in any two of them.

- _____ stepped on the Moon with Neil Armstrong.
 - _____ planet takes 84 years to revolve around the Sun.
 - _____ is the thickest layer of Earth.
 - Revolution of Earth around Sun and _____ causes changes in seasons during a year.
- (i) Michael Collins, (ii) Uranus
 - (ii) Saturn, (iv) Gravitational pull of Sun
 - (iii) Mantle, (iv) Tilted axis of Earth
 - (i) Edwin Aldrin, (iii) Crust

SOF NSO 2018 QUESTIONS

1. Total lunar eclipse occurs only on the night of a

- Full Moon
- New Moon
- Half Moon
- Crescent Moon. (Level-1)

2. Suniti keeps observing phases of the moon appearing on different nights. On November 10, she observed . Which phase of Moon, she would most likely

observe on November 13 and November 16?

	November 13	November 16
(A)		
(B)		
(C)		
(D)		

(Level-1)

3. Refer to the given flow chart and select the option which identifies planets P-S.

```

graph TD
    A[It is a planet.] -- Yes --> B[It lacks rings system around it.]
    B -- Yes --> C[It rotates from East to West.]
    C -- Yes --> P[P]
    C -- No --> Q[Q]
    B -- No --> D[It is the largest planet of solar system.]
    D -- Yes --> R[R]
    D -- No --> S[S]
  
```

P	Q	R	S
(A) Neptune	Uranus	Mars	Venus
(B) Venus	Earth	Jupiter	Saturn
(C) Uranus	Saturn	Earth	Mercury
(D) Jupiter	Saturn	Mars	Venus

(Level-1)

4. Planet X is closer to Sun than planet Y. It can be inferred that _____.

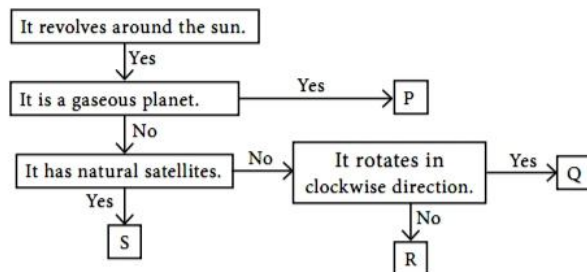
- (A) Planet X has longer revolution period than planet Y
 (B) Planet Y has longer revolution period than planet X
 (C) Planet X has longer rotation period than planet Y
 (D) Planet Y has longer rotation period than planet X
- (Level-1)

5. If a Full Moon appeared on November 1 then which of the following shapes of Moon will be observed on November 7?

(A)		(B)	
(C)		(D)	

(Level-1)

6. Refer to the given flow chart.



Select the correct option regarding P, Q, R and S.

- (A) P could be the hottest planet whereas Q could be the coldest planet of solar system.
 (B) R could be the smallest planet whereas S could be the red planet.
 (C) P could be the largest planet whereas R is the planet known as morning star and evening star.
 (D) Q has rings around it whereas S has no ring system.
- (Level-1)

7. Refer to the given list of planets.

- | | |
|---------------|--------------|
| (i) Uranus | (ii) Jupiter |
| (iii) Neptune | (iv) Mars |
| (v) Earth | |

Select the option which arranges these planets in ascending order regarding their number of natural satellites.

- (A) (i) < (iii) < (v) < (ii) < (iv)
 (B) (iv) < (ii) < (v) < (iii) < (i)
 (C) (iv) < (iii) < (i) < (v) < (ii)
 (D) (v) < (iv) < (iii) < (i) < (ii)
- (Level-1)

8. Identify planet X in the given sequence of planets of Solar System with respect to Sun and select the correct option regarding it.

Earth, X, Jupiter, Saturn

- (A) X has 63 moons.
 (B) Carbon dioxide is absent in the atmosphere of X.
 (C) X is also called the red planet.
 (D) X is the hottest planet of Solar System.
- (Level-1)

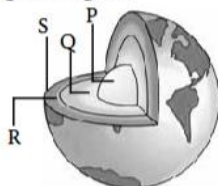
9. Tides are caused by _____.

- (A) Gravitational pull of Earth
 (B) Movement of large ships in water body
 (C) Gravitational pull of Moon
 (D) None of these
- (Level-1)

10. Which of the following constellations was named after a hunter in Greek mythology?

- (A) Ursa Major (B) Orion
 (C) Ursa Minor (D) Scorpius
- (Level-1)

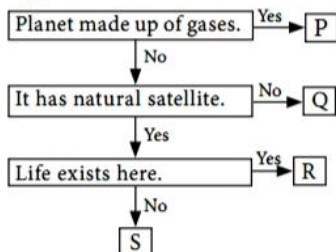
11. Observe the given figure.



From which of the following layers does molten magma come out when a volcano erupts?

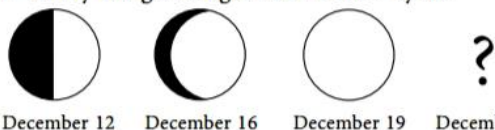
- (A) P (B) Q
(C) R (D) Both Q and S (Level-2)

12. Study the given flow chart and select the correct option regarding P – S.

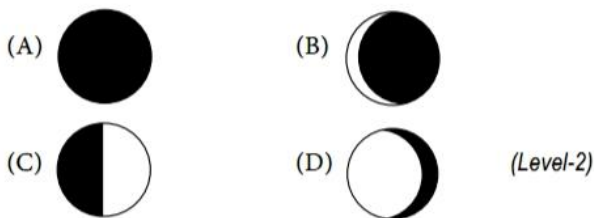


- (A) P could be the largest planet whereas Q could be the red planet.
(B) Q could be known as morning and evening star whereas R could be the lightest planet.
(C) Q could be the hottest planet whereas P could be the coldest planet.
(D) Q and S may have rings orbiting them whereas R may have no rings orbiting them. (Level-2)

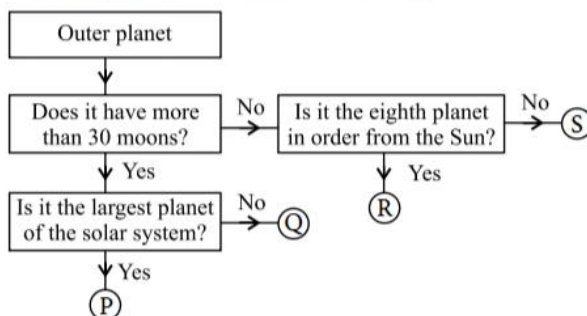
13. Study the given figures of a lunar cycle.



Which of the following shows the correct shape of the Moon on December 22?



14. Study the given flow chart carefully.



Which of the following correctly lists the names of planets that can be placed at P, Q, R and S in the given flowchart?

- | | P | Q | R | S |
|-----|---------|---------|---------|---------|
| (A) | Saturn | Jupiter | Uranus | Neptune |
| (B) | Saturn | Uranus | Jupiter | Neptune |
| (C) | Jupiter | Neptune | Saturn | Uranus |
| (D) | Jupiter | Saturn | Neptune | Uranus |
- (Level-2)

15. What is the main reason that some places on the Earth are warmer than others?

- (A) The Sun is closer to some places than others.
(B) The Sun stays above the horizon 24 hours a day in some places.
(C) The rays of the Sun are more direct at some places and more slanting at others.
(D) Some places experience warm seasons because of underground heat. (Level-2)

HINTS & EXPLANATIONS

SELF TEST - 1

1. (C) : The gravitational force of Earth pulls everything towards itself.
2. (D) : Venus is the hottest planet, it shines so brightly, that it is called the morning and evening star.
3. (A)
4. (C) : The outer core of Earth is rich in iron and nickel whereas the inner core is rich in iron.
5. (A)

SELF TEST - 2

1. (B) : In the given figure P, Q and R represent Sun, Earth and Moon respectively.
2. (D)
3. (C)
4. (C) : Both natural satellites and artificial satellites revolve around the Earth. Moon is a natural satellite. Artificial satellites are man-made.
5. (B) : Neil Armstrong was the first person to step on the Moon. Sunita Williams was a woman of Indian origin to go into the space. Only artificial satellites are used for communication, weather forecasting, etc.

EXERCISE

1. (A) : On unscrambling options A, B and C, we get SCORPIUS, ORION and CASSIOPEIA respectively. The given figure is of Scorpius.
2. (C) : Venus shines brightly in the sky. It is known as the morning and evening star. It takes around 224 days to revolve around the Sun and it does not have any natural satellite.
3. (D) : The iron rich inner core is in solid state.
4. (C) : Options A, B, C and D represent Full Moon, Gibbous Moon, Crescent Moon and New Moon respectively. During Crescent Moon very small part of the Moon is illuminated.
5. (B) : Uranus is an outer planet while Venus, Earth and Mercury are inner planets.
6. (D)
7. (D) : Mercury in Hindi is called *Budh* and Uranus in Hindi is called *Arun*.
8. (D) : When the Moon (natural satellite) moves into the dark shadow of the Earth and is completely covered by it, then it is called total lunar eclipse.

9. (C) : Different shapes of the Moon are visible from the Earth. The shape during a particular phase depends on the illuminated part of the Moon that can be seen by us from the Earth.

10. (B) : In the first half of the cycle, the size of lighted part of the Moon increases from New Moon to Full Moon. This is called waxing phase of Moon. In the second half of cycle, the size of lighted part of the Moon decreases from Full Moon to New Moon. This is called waning phase of Moon.

11. (B) : The Sun, Earth and Moon come in a straight line during an eclipse. When the Moon comes between the Sun and Earth, solar eclipse occurs and when Earth comes in between the Sun and Moon, lunar eclipse occurs.

12. (B) : On unscrambling options A, B, C and D we get CORE, PHOTOSPHERE, ATMOSPHERE and CORONA respectively. Photosphere is the visible surface of the Sun that gives off light.

13. (D) : Artificial satellites help in communication, weather, forecasting, navigation, etc. High tides are formed due to Earth's natural satellite (Moon).

14. (C) : The lunar cycle has two phases, i.e., waxing phase and waning phase. When the lighted part of the Moon increases from New Moon to Full Moon, it is the waxing phase and when the lighted part of the Moon decreases from Full Moon to New Moon, it is the waning phase of Moon. Phases of Moon from December 21 to December 28 are part of waxing phase. From December 28 starts the waning phase. So, the size of the illuminated part of the Moon will reduce slightly. Hence, waning Gibbous Moon will be observed.

15. (A)

16. (C) : Man first time landed successfully on Moon On 20th July 1969. Kalpana Chawla was the first Indian woman of Indian origin to go into the space.

17. (A) : P could be Sun as it has gravity and it gives its own light. R could be Earth as it has gravity and it revolves around a heavenly body (Sun).

18. (D)

19. (C) : Circular path in which planet revolves-Orbit. Middle layer of Earth - Mantle.

A phenomena caused due to gravity of Moon - Tide. Huge pits on the surface of Moon - Crater.

20. (C) : (i) Edwin Aldrin, (ii) Uranus, (iii) Mantle, (iv) Tilted axis of Earth,

SOF NSO 2018 QUESTIONS

1. (A) : A lunar eclipse occurs when the Earth comes between the Sun and the Moon. The earth casts a shadow on the Moon. When the Moon is completely hidden by the shadow of the Earth, it is a total lunar eclipse. It occurs on the night of a Full Moon.

2. (C)

3. (B) : Venus rotates from East to West and lacks rings around it. Planet that rotates from West to East and lacks rings around them are Mercury, Earth and Mars. Jupiter is the largest planet of the solar system with rings around it. Other planets having rings around them are Saturn, Uranus and Neptune.

4. (B) : Farther a planet is from the Sun, larger is its orbit because circles of larger radii have larger periphery. So, it will take more time to complete a revolution *i.e.*, to cover the entire length of its orbit.

Planet X is closer to Sun, thus, its orbit will be smaller. So, it will take lesser time to complete a revolution. Orbital size has no impact on rotation.

5. (B) : After Full Moon the waning phase of lunar cycle starts. Hence, the lit part of the Moon will decrease from Full Moon to New Moon. Six days after Full Moon, Waning Half Moon will be observed.

6. (B) : In the given flow chart, P can be any outer planet, *i.e.*, Jupiter, Saturn, Uranus or Neptune. Q, R and S are inner planets. Q could be Venus as it does not have natural satellite and rotates in clockwise direction. R could be Mercury as it does not have natural satellite and moves in anti-clockwise direction. S could be Mars or Earth as they have natural satellites.

7. (D)

8. (C) : Mars is present in between Earth and Jupiter. It is also called the red planet.

9. (C) : Tide is the condition when water level of oceans and seas rises up to a certain level and then after a while recedes down. Tides occur due to gravitational pull of the Moon.

10. (B) : Orion is the constellation, which was named after a hunter in greek mythology.

11. (C) : In the given figure P, Q, R and S are inner core, outer core, mantle and crust respectively. Molten magma present in the mantle comes out when a volcano erupts.

12. (C) : In the given flowchart P could be any outer planet, *i.e.*, Jupiter, Saturn, Uranus or Neptune. Q, R and S are inner planets. Q could be Mercury or Venus as they do not have natural satellites. R could be Earth as it has natural satellite and it also has life. S could be Mars as it has natural satellite but does not have life. Venus is the hottest planet and Uranus is the coldest planet.

13. (D) : After Full Moon waning phase of lunar cycle, starts. Hence, lit part of the Moon will decrease from Full Moon to New Moon. If Full Moon is observed on December 19 then after three days, *i.e.*, on December 22 waning Gibbous Moon will be observed.

14. (D) : In the given flow chart P, Q, R and S are all outer planets. P could be Jupiter as it has more than 30 moons and it is the largest planet of the solar system. Q could be Saturn as it has more than 30 moons and is not the largest planet. R could be Neptune as it has less than 30 moons and is the eighth planet from the Sun. S could be Uranus as it has less than 30 moons and is not the eighth planet from the Sun.

15. (C) : The Earth is tilted on its axis, due to which some places get direct vertical rays of Sun and are hotter like equator while some places have slanting sun rays and are cooler.



Matter and Materials

Learning objectives

7.1 States of matter

7.4 Solutions

7.2 Changes in the states of matter

7.5 Physical and chemical changes

7.3 Expansion and contraction

7.6 Properties of materials

Objects are made of different materials. Same material can be used to make different kinds of things. Materials can be sorted out into groups on the basis of their appearance, shape, size, colour, etc. The word 'material' is related to matter.

Anything that occupies space and has mass is called **matter**. All living and non-living things are made up of matter. All matter is made up of very small particles called **molecules** and molecules are further composed of very small particles called **atoms**.



Matter has weight



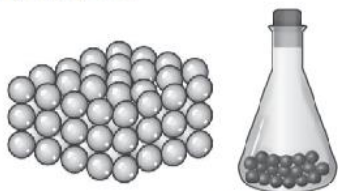
Matter occupies space

7.1 STATES OF MATTER

There are three states of matter—solid, liquid and gas. Matter can change its form from one state to another and the three states of matter are interchangeable.

Solids

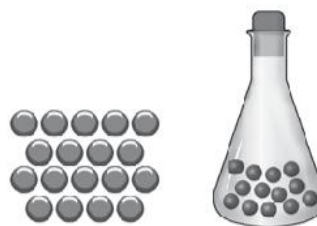
Molecules in a solid are packed tightly as there is strong force of attraction between them. They cannot move around freely. This is why solids have a fixed shape and size. They are incompressible. Solids may be hard like wood, stone, table, etc. or they may be soft like powder, cloth, etc.



Arrangement of molecules in solids

Liquids

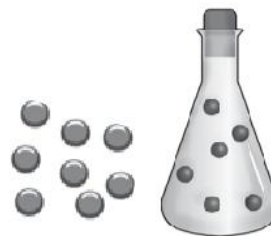
Molecules in a liquid are less tightly packed as force of attraction between them is weak as compared to that in solids. So, they can move in different directions. Therefore, liquids can change their shape and take the shape of the container they are put in. Their volume always remains the same. They compress negligibly. Water, petrol, soft drink and milk are examples of liquids.



Arrangement of molecules in liquids

Gases

Molecules in gases are loosely packed as compared to solids and liquids as force of attraction between them is almost negligible. So, they move freely in all directions and fill the entire space available to them. They neither have definite shape, nor definite volume. Gases cannot be seen, they can only be felt. They can also be compressed. Oxygen, nitrogen, carbon dioxide, water vapour are some examples of gases.



Arrangement of molecules in gases

Table : States of matter at molecular level

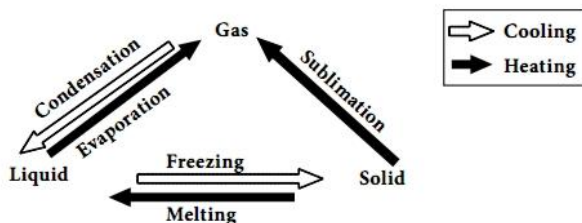
Features	Solid	Liquid	Gas
Arrangement of molecules	Regular and very close to each other	Random or irregular and less close to each other	Random and wide apart
Movement of molecules	Very little movement, in the form of vibrations	Molecules can move around each other	Quick movement in random direction
Volume	Definite	Definite	Not definite
Shape	Definite	Not definite	Not definite
Examples	Rock, Book, Pencil	Water, Milk, Oil	Water vapour, Oxygen, Carbon dioxide

SELF TEST - 1

- What is matter?
(A) Anything that has colour and takes up no space.
(B) Anything that has mass and occupies space.
(C) Anything that has temperature and is massless.
(D) Anything that has volume but no mass.
- Select the incorrect statement.
(A) Molecules in a solid are tightly packed.
(B) Gases do not have definite shape and volume.
(C) Liquid have fixed shape.
(D) Gas molecules fill the entire space available to them.
- The arrangement of _____ molecules is random and less close to each other.
(A) Solid (B) Liquid
(C) Gas (D) Both (A) and (B)
- Select the group in which the odd one is encircled incorrectly.
(A) Water, Petrol, Oxygen, Soft drink
(B) Carbon dioxide, Nitrogen, Carbon monoxide, Plastic
(C) Paper, Wood, Cloth, Methane
(D) Stone, Table, Syrup, Rubber
- Select the correct statement regarding the similarity between dew and water vapour.
(A) Both of them can not be compressed.
(B) Both of them do not have a definite volume.
(C) Both of them are in a form of water droplets.
(D) Both of them do not have definite shape.

7.2 CHANGES IN THE STATES OF MATTER

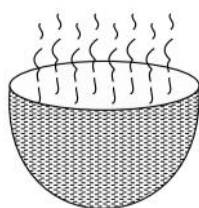
Matter changes its state from one form to another on **heating** or **cooling**. When matter changes its state, the molecules move closer together or further apart.



Heating

Evaporation

The process by which a liquid changes into its gaseous form at any temperature below its boiling point is called **evaporation**. On heating, the molecules in the liquid move faster and break free



Water evaporates at all times

from their existing arrangement. Finally, they escape into the air as gas, e.g., water on heating evaporates or changes into water vapour faster. The rate of evaporation increases with the increase in temperature and it is also affected by the surface area. The greater the surface area, the faster is the evaporation.

Melting

The process of conversion of a solid into liquid on heating is called **melting**. On heating, the molecules in solid start vibrating faster and finally break away from the rigid pattern. The molecules become loosely packed as in a liquid e.g., ice cubes change to water when taken out of the refrigerator.



Sublimation

The process of conversion of a solid directly into a gas on heating without going through liquid phase is called **sublimation**. For example, the naphthalene balls become gas and reduce in size or may disappear.



Olympiad Bite

- Melting point of a solid is a fixed temperature at which it starts to change into liquid on heating.
- The boiling point of a liquid is a fixed temperature at which it starts to change into vapour form on heating.

Cooling

Condensation

The process of conversion of a gas into liquid on cooling is called **condensation**. When the freely flowing molecules of a gas, for example, water vapour touch a cold surface, they cool down. Cooling results in slowing down of the movement of molecules. The attraction between the molecules increases and they come close together and change from gas to liquid.



Water vapour
condense on
cooling

Freezing

The process of conversion of a liquid into its solid form on cooling is called **freezing**. It is a type of solidification. For example, water on cooling becomes ice. When the liquid is cooled, the movement of its

molecules decreases and they will pack themselves into a rigid shape, thus forming a solid.

7.3 EXPANSION AND CONTRACTION

When substance is heated, the molecules start moving rapidly. Thus, each molecule takes up more space due to their increased movement and thus, the substance expands. This is called **expansion**. For example, a tight metal lid of glass jar can be opened by dipping it in hot water because the heat of the water causes the lid to expand a little and open out easily.



Olympiad Bite

Usually substances expand on heating but water expands on freezing. Thus, ice occupies more space than water. This is the reason why a fully filled water bottle kept in freezer breaks after some time.

When substance is cooled the movement of the molecules slows down. Due to decreased movement, molecules take up less space and thus contract. This is called **contraction**. For example, electric cables hang loosely (expand) in summer but do not appear loose in winter as they contract back.

SELF TEST - 2

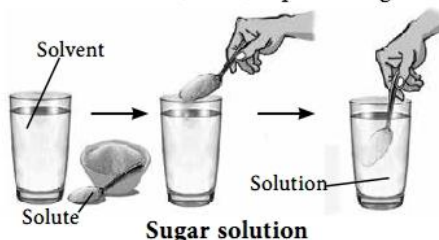
- Which of the following factors does not affect the rate of evaporation?
(A) Surface area (B) Wind
(C) Temperature (D) None of these
- Changing of a solid into gas on heating is called
(A) Freezing (B) Melting
(C) Condensation (D) Sublimation.
- Select the correct statement.
(A) The space occupied by a substance in solid form increases on heating.
(B) Electric cables hang loosely in winter.
- The movement of molecules in a substance decreases on heating.
(D) All of these
- Find the incorrect pair of opposite processes.
(A) Expansion-Contraction
(B) Evaporation-Condensation
(C) Freezing-Cooling
(D) Freezing-Melting
- Which process is involved in the drying of a wet floor?
(A) Evaporation (B) Contraction
(C) Condensation (D) Sublimation

7.4 SOLUTIONS

Solubility of a substance is its property to dissolve in some other substance to form a mixture of uniform nature. The substance which gets dissolved is called **solute**. The other substance in which the solute gets dissolved is called **solvent**. The resulting uniform mixture formed is called **solution**. For example, when sugar is added to water, it dissolves to form solution. Here, sugar is the solute and water is the solvent.

Generally, solvent is present in major proportion compared to solute. The solute and solvent can be in

any state of matter i.e., solid, liquid and gas.



Solutions may be of different types, depending upon the states of the solute and solvent present in the solution.

Solid dissolved in liquid : This type of solution is formed when the solute is solid and solvent is liquid, e.g., sugar solution, salt solution.

Liquid dissolved in liquid : This type of solution is formed when the solute and solvent both are liquids, e.g., antifreeze

Gas dissolved in liquid : This type of solution is formed when the solute is gas and solvent is liquid, e.g., carbonated drinks, air (oxygen) dissolved in water bodies. In carbonated drinks, carbon dioxide is dissolved in water under pressure. The pressure decreases on the opening of bottle and it escapes out in the form of bubbles. Aquatic animals breathe in oxygen dissolved in water.

Gas dissolved in solid : This type of solution is formed when the solute is gas and solvent is solid, e.g., hydrogen dissolved in metals.

Liquid dissolved in solid : This type of solution is formed when the solute is liquid and solvent is solid, e.g., mercury in silver.

Solid dissolved in solid : This type of solution is formed when both the solute and solvent are solids, e.g., steel.

Gas dissolved in gas : This type of solution is formed when both solute and solvent are gases e.g., air.



Olympiad Bite

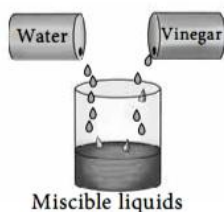
- Water is a very good solvent. Most of the substances readily dissolve in water giving it the status of "Universal solvent".
- The solubility of solids in water generally increases with an increase in temperature.
- The solubility of gases in water decreases with an increase in temperature.

Table : Types of solutions

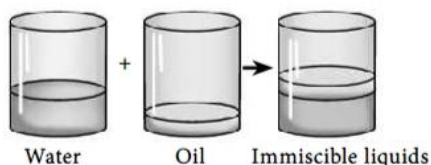
Example	Type of solution	Solute (State of matter)	Solvent (state of matter)
Air	Gas in gas	Oxygen (gas)	Nitrogen (gas)
Soft drink	Gas in liquid	Carbon dioxide (gas)	Water (liquid)
Hydrogen in platinum	Gas in solid	Hydrogen (gas)	Platinum (solid)
Antifreeze	Liquid in liquid	Ethylene glycol (liquid)	Water (liquid)
Mercury in gold	Liquid in solid	Mercury	Gold
Sugar solution	Solid in liquid	Sugar (solid)	Water (liquid)
Brass	Solid in solid	Zinc (solid)	Copper (solid)

Miscible and immiscible liquids

When two liquids mix together such that they dissolved completely in each other and form a single layer are called **miscible liquids**. For example, vinegar dissolves in water completely.



When two liquids mix together such that they do not dissolve completely in each other and form separate layers, they are called **immiscible liquids**. For example, oil does not dissolve in water and form two separate layers within the container.



7.5 PHYSICAL AND CHEMICAL CHANGES

Everything around us undergoes certain changes. Changes can be either physical or chemical.

Physical Changes

Physical change is a type of change in which only the physical properties of a substance changes and no new products are formed. Physical properties of a substance include colour, size, shape, state, temperature, texture etc.

- It does not affect the composition or chemical nature of the matter.
- It may involve a change in the state of matter.
- It can often be reversed.
- A common example of physical change is the conversation of states of water. Ice, water and water vapour are the three physical states of water. Other examples are melting of chocolate, dissolving sugar, etc.



Melting of ice



Breaking of pencil

Physical changes

Chemical changes

Chemical change is a type of change in which the chemical composition of a substance changes and a new substance is formed.

- It results in the formation of a new substance with different properties.
- It is a permanent change and cannot be reversed.
- For example, rusting of iron, burning of paper, souring of milk, rotting of fruits, etc.



Rusting of iron



Frying of egg

Chemical changes

SELF TEST - 3

- Select the activity that is an example of physical change.
 - Rusting of iron nails
 - Burning of paper
 - Melting of chocolate
 - Making curd from milk
- Select the group in which the odd one is encircled incorrectly.
 - Salt, Sugar, Kerosene
 - Hydrogen, Palladium, Platinum
 - Sugar, Salt, Water
 - Petrol, Kerosene, Sugar
- Which of the following is an example of immiscible liquids?
 - Oil in water
 - Vinegar in water
 - Ink in water
 - Lemon juice in water
- Nirvan's mother bought a machine which changes lemon juice to lime soda. The machine probably must be pumping
 - Oxygen
 - Carbon dioxide
 - Nitrogen
 - Water vapour.
- In carbonated drinks, the solute is _____ and solvent is _____.
 - Liquid, Gas
 - Liquid, Liquid
 - Gas, Solid
 - Gas, Liquid

7.6 PROPERTIES OF MATERIALS

Various objects around us are made up of different kinds of materials. They differ from each other on the basis of different properties. Materials can be classified based upon various properties like appearance, solubility, transparency etc.

Appearance

Materials can be differentiated from each other on the basis of their appearance. This is because the nature of materials from which they are made differs from each other. For example, rubber appears very different from wood.

Metals like copper, silver, gold have a common property, they all shine. The shine seen on a material is known as **lustre**. On the basis of shining property, materials are classified as–

Lustrous objects : These are the objects which shine because of their ability to reflect light *e.g.*, copper vessel, tin container, etc.



Non-lustrous objects : These are the objects which do not shine *e.g.*, graphite, wooden table, etc.



Transparency

Transparency is the property of a material which tells whether we can see through the object or not. Materials can be classified on the basis of transparency (the amount of light that can pass through an object) as–

Transparent objects : Materials that allow light to pass through them completely are called **transparent materials** *e.g.*, glass, air, etc.



Opaque objects : Materials that do not allow light to pass through them and block the light are called **opaque materials**. We cannot see through them *e.g.*, wood, stone, metal, etc.



Translucent objects : Materials that allow the light to pass through them partially are called **translucent materials**. We can partially see through them. So, we can call them as "semi-transparent". Frosted glass and some plastics are examples of translucent materials.



Hardness

Materials can be classified on the basis of their hardness as hard or soft.

Materials or objects that cannot be scratched easily are called **hard** e.g., aluminium, diamond, etc. Materials or objects that can be scratched easily are called **soft**, e.g., butter, chalk, etc.

Texture

The feel of any material is known as **texture**. Based on texture, materials can be **rough** or **smooth**. The surface of a paper feels smooth whereas the bark of a tree feels rough.



Solubility

Materials such as salt, sugar, etc which can completely dissolve in water are called **soluble materials**. Materials such as mustard oil, wax, petrol, etc. which do not dissolve in water are called **insoluble materials**.

Floatation

The property of floating or sinking of an object depends on its density. The mass per unit volume of a substance is known as **density**. Materials that are less dense than water, float on water e.g., feather, paper boats, etc. Materials more dense than water, sink e.g., iron nail, metal coins, etc.

Magnetic property

Based on magnetic property, materials can be magnetic or non-magnetic. The materials which get attracted towards a magnet are called **magnetic materials** e.g., iron, nickle, etc. The materials which do not get attracted towards a magnet are called **non-magnetic materials** e.g., plastic, rubber, etc.

Conductivity

Materials which allow electric current to pass through them are called **conductors of electricity** e.g., silver. Materials which do not allow electric current to pass through them are called **insulators** e.g., plastic, wood, rubber, etc.

Materials which allow heat to pass through them are called **good conductors of heat** e.g., copper, silver, etc. Materials which do not allow heat to pass through them are called **bad conductors of heat** e.g., wood, rubber, plastic, etc.

SELF TEST - 4

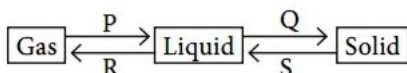
- You will be easily spotted, if you hide yourself behind a
 - Wooden almirah
 - Glass window
 - Metallic door
 - All of these
- Which of the following does not have lustre?
 - Gold ring
 - Copper vessel
 - Silver plate
 - Wooden table
- Which of the following materials will sink in water?
 - Rubber band
 - Thermocol
 - Key
 - Leaf
- Which pair of substances among the following are good examples of insulators?
 - Plastic, Silver
 - Copper, Wood
 - Glass, Aluminium
 - Rubber, Glass
- Select the correct match.
 - Silk cloth - Rough
 - Wood - Translucent
 - Eraser - Lustrous
 - Frosted glass - Semi-transparent

EXERCISE

1. A substance 'X' does not have a fixed volume and it occupies the total space of the container. It can be compressed. What is 'X' likely to be?

- (A) Solid (B) Gas
(C) Liquid (D) All of these

2. Refer to the given diagram that represents change of state of a substance through processes P, Q, R and S. Select the option which correctly identifies P, Q, R and S.



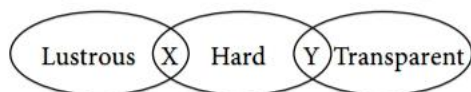
- | P | Q | R | S |
|------------------|--------------|--------------|-------------|
| (A) Condensation | Freezing | Evaporation | Melting |
| (B) Sublimation | Condensation | Melting | Evaporation |
| (C) Evaporation | Freezing | Condensation | Melting |
| (D) Melting | Condensation | Sublimation | Freezing |

3. Three glasses L, M and N having equal amount of water were taken at room temperature and equal amount of sugar was added to each one of them. After that, L was heated, M was cooled and N was left undisturbed. Sugar in which glass will dissolve faster?



- (A) L (B) M
(C) N (D) All of these

4. Identify X and Y in the given Venn diagram.



- (A) X could be wood
(B) Y could be glass
(C) X could be silver vessel
(D) Both (B) and (C)

5. Select the incorrect match among the following.

- (i) Melting of chocolate-Physical change
(ii) Cooking of food-Chemical change
(iii) Melting of ice-Chemical change
(iv) Rusting of iron-Physical change

- (A) (i) and (iv) only (B) (iii) and (iv) only
(C) (i) and (ii) only (D) (i), (iii) and (iv) only

6. Match column I with column II and select the correct option from the given codes.

Column I	Column II
P. Book	(i) Transparent
Q. Aluminium	(ii) Magnetic
R. Air	(iii) Conductor
S. Iron	(iv) Non-lustrous

- (A) P-(iv), Q-(ii), R-(iii), S-(i)
(B) P-(i), Q-(iv), R-(iii), S-(ii)
(C) P-(iv), Q-(iii), R-(i), S-(ii)
(D) P-(iv), Q-(i), R-(iii), S-(ii)

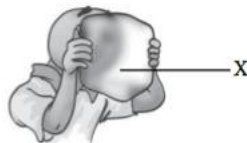
7. Which of the following statements are incorrect?

- (i) Germination of seeds is an example of physical change.
(ii) Material less dense than water will float on water.
(iii) Materials which can be compressed or scratched easily are called hard materials.
(iv) Evaporation is faster when the surface area is larger.
(A) (i) and (iv) only (B) (ii) and (iii) only
(C) (ii) and (iv) only (D) (i) and (iii) only

8. Select the option that correctly gives the examples of liquids that are miscible and immiscible with water.

Miscible liquid	Immiscible liquid
(A) Vinegar	Coconut oil
(B) Lemon juice	Milk
(C) Mustard oil	Fruit juice
(D) Sand	Chalk powder

9. Tanmay is trying to look through a material X. Which of the following statements is true?



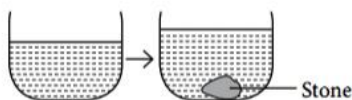
- (A) X is a chart paper and Tanmay will be able to see clearly through it.
(B) X is an aluminium foil and Tanmay will be able to see partially through it.
(C) X is a frosted glass and Tanmay will be able to see partially through it.
(D) None of these

10. Read the given statement and fill up the blanks with the correct option.

(i) has neither definite shape nor definite volume whereas _(ii)_ has definite volume but no definite shape.

- | | |
|--------------|--------------|
| (i) | (ii) |
| (A) Juice | Ink |
| (B) Vinegar | Oxygen |
| (C) Nitrogen | Milk |
| (D) Oil | Water vapour |

11. Rima drops a stone into a trough of water. She notices that the level of water rises in the trough.



The experiment that Rima has done tells that the stone _____.

- (A) Has no mass
(B) Has no the same volume as the water
(C) Has no volume
(D) Occupies space

12. Consider the following statements and select the option which correctly identifies true (T) and false (F) ones.

- (i) When a substance changes from liquid state to gaseous state, the molecules of the substance become loosely packed and move freely in all directions.
(ii) Melting changes water from a state with definite shape and volume to a state with no definite shape and volume.
(iii) Oxygen cannot be compressed.

- | | | |
|-------|------|-------|
| (i) | (ii) | (iii) |
| (A) T | T | T |
| (B) F | T | T |
| (C) T | T | F |
| (D) T | F | F |

13. 'X' does not allow electricity or heat to pass through it. Select the option that gives name of 'X' on unscrambling.

- | | |
|--------------|---------------|
| (A) SOUSTLUR | (B) ETLITRB |
| (C) QPEUAO | (D) RANUITLSO |

14. Select the incorrect match from the following.

- (A) Expansion–Movement of particles of a substance slows down.

(B) Sublimation–Conversion of a solid directly into a gas.

(C) Evaporation–Particles on the surface of the liquid move faster and escape into the air.

(D) Freezing–Conversion of a liquid into its solid form.

15. A ball has a volume of 450 cm^3 . It is first pumped with 430 cm^3 of air. Then another 50 cm^3 of air is pumped into it. What will be the final volume of air inside the ball?

- | | |
|------------------------|------------------------|
| (A) 430 cm^3 | (B) 450 cm^3 |
| (C) 480 cm^3 | (D) 500 cm^3 |

Achievers Section (HOTS)

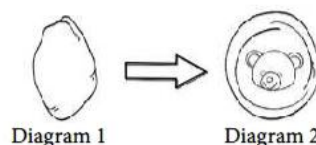
16. The given table represents the characteristics of three different objects P, Q and R.

Characteristics	Objects		
	P	Q	R
Floats on water	✓	×	×
Stretched easily	✓	×	×
Lustrous	×	✓	×

Which of the following could be P, Q and R?

- | | | |
|-----------------|----------------|--------------|
| P | Q | R |
| (A) Rubber band | Coin | Stone |
| (B) Glass | Jewellery | Plastic bag |
| (C) Paper | Key | Feather |
| (D) Thermocol | Metallic sheet | Plastic ball |

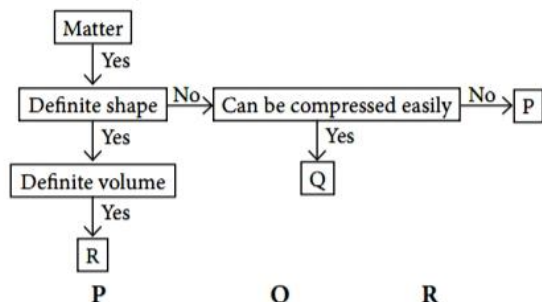
17. Sushma flattened a ball of plasticine as shown in diagram 1. She then used a stamp to make an imprint onto the plasticine as shown in diagram 2.



Which of the following properties had changed when the ball of plasticine was changed as shown in diagram 1 to diagram 2?

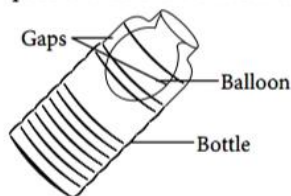
- | | |
|------------|--------------|
| (i) Colour | (ii) Texture |
| (iii) Mass | (iv) Shape |
- (A) (i) and (iv) only
(B) (i) and (ii) only
(C) (ii) and (iv) only
(D) (i), (iii) and (iv) only

18. Refer to the given flow chart and select the option which correctly identifies P-R.



- | | | |
|-----------------|--------------|--------|
| (A) Apple juice | Coffee | Eraser |
| (B) Milk | Water vapour | Pencil |
| (C) Oxygen | Salt water | Cookie |
| (D) Nitrogen | Lamp | Tea |

19. Meera secures a deflated balloon over the mouth of a bottle as shown in the given figure. She then tries to pump air into the balloon. However, she realises that it is almost impossible to blow the balloon up.



Why is it not possible for the balloon to inflate inside the bottle?

- (A) The balloon is not elastic enough.
 (B) The air inside the bottle occupies space.
 (C) The air in the balloon cannot be compressed.
 (D) The bottle has a fixed shape.

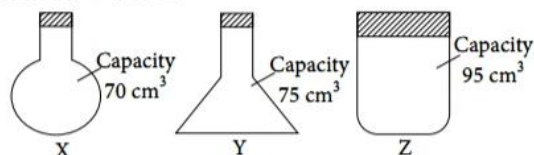
20. Four pieces of materials, W, X, Y and Z, of similar size, had their masses measured individually. Then they were submerged into a container of water. After soaking for ten minutes, W, X, Y and Z were removed from container. They were each weighed again. Their masses are shown in the table below.

Material	Mass before submerging in water (g)	Mass after removing from water (g)
W	6	8
X	12	19
Y	4	4
Z	16	20

Which material is most suitable to make a raincoat?

- (A) W (B) X
 (C) Y (D) Z

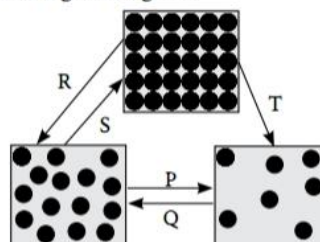
1. Refer to the given figure representing three different vessels X, Y and Z.



Which of the given vessels can contain 80 cm³ of air?

- (A) Z only (B) X and Y only
 (C) Y and Z only (D) X, Y and Z (Level-1)

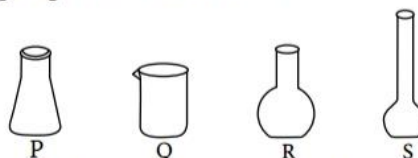
2. Refer to the given figure.



Identify processes P-T and select the correct option.

- (A) Process S is involved in obtaining salt from sea water whereas process P is involved in formation of ice cube.
 (B) Process P is involved in drying of wet soil whereas process T is involved in reduction of size of naphthalene ball.
 (C) Process Q is involved in defrosting of refrigerator whereas process S is involved in drying of wet clothes.
 (D) None of these (Level-1)

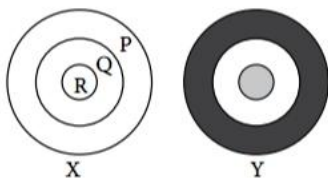
3. 200 mL of water at 25°C was poured into each of the given containers P-S. The containers were then left in an open garden under the sun.



Which of the following containers will have maximum volume of water after a few hours?

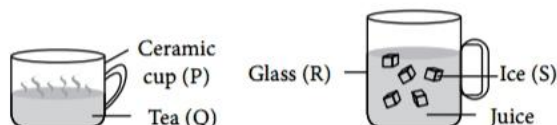
- (A) P (B) Q
 (C) R (D) S (Level-1)

4. Figure X shows an object which is made of three different materials P, Q and R. Figure Y shows its shadow on a screen. Study these figures and select the option that correctly identifies any two of these materials.



- (A) P - Tissue paper; Q - Wood
 (B) Q - Metal; R - Cellophane paper
 (C) P - Wood; R - Frosted glass
 (D) P - Butter paper; R - Cardboard (Level-1)

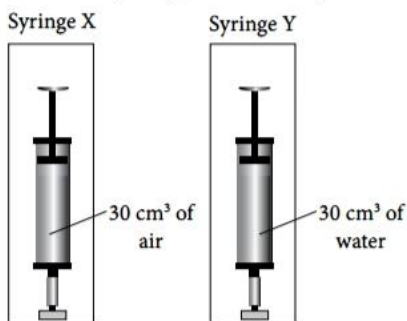
5. Aditya and Vidya went to the restaurant and ordered hot tea and chilled apple juice, respectively. The waiter served these as shown in the given figure.



Which of the following options correctly identifies heat changes in labelled parts (P-S)?

- | | P | Q | R | S |
|-----|-----------|-----------|-----------|-----------|
| (A) | Heat gain | Heat loss | Heat gain | Heat loss |
| (B) | Heat gain | Heat loss | Heat loss | Heat gain |
| (C) | Heat loss | Heat gain | Heat gain | Heat loss |
| (D) | Heat gain | Heat gain | Heat loss | Heat gain |
- (Level-1)

6. Refer to the given figure showing two syringes, X and Y. Syringe X contains 30 cm^3 of air while syringe Y contains 30 cm^3 of water. The ends of both the syringes are sealed and the plungers are then pushed in.



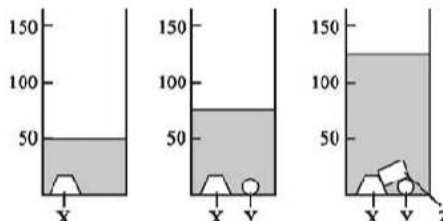
Which of the following graphs correctly represents the volume of air in syringe X and volume of water in syringe Y as the plunger is pushed in?

- (A) (B)

- (C) (D) (Level-1)

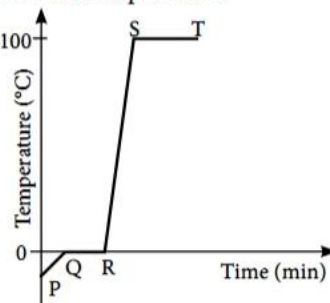
7. Amol has three objects, X, Y and Z. He puts X into a measuring cylinder with 30 mL of water. Then he puts Y and Z one by one into the same measuring cylinder as shown.

Which of the objects has/have a volume less than 30 mL?



- (A) X only (B) Y only
 (C) X and Y only (D) X, Y and Z (Level-1)

8. Refer to the given graph representing changes in the states of water with temperature.

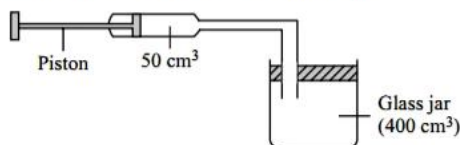


Based on the given graph which of the following statements are correct?

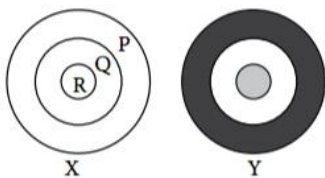
- (i) Heat is gained from P to T.
 (ii) There are different states of water along QR.
 (iii) Vaporisation occurs at P to Q.
 (A) (i) and (ii) only (B) (ii) only
 (C) (ii) and (iii) only (D) (i), (ii) and (iii) (Level-1)

9. The given diagram shows a pump connected to a glass jar. The volume of the glass jar is 400 cm^3 and it is filled with air. When the piston is pushed in completely, 50 cm^3 of air is forced into the jar.

What is the final volume of air in the jar?

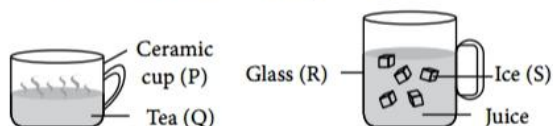


- (A) 50 cm^3 (B) 350 cm^3
 (C) 400 cm^3 (D) 450 cm^3 (Level-1)



- (A) P - Tissue paper; Q - Wood
 (B) Q - Metal; R - Cellophane paper
 (C) P - Wood; R - Frosted glass
 (D) P - Butter paper; R - Cardboard (Level-1)

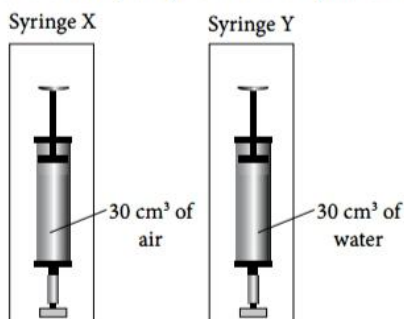
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Which of the following options correctly identifies heat changes in labelled parts (P-S)?

- | | P | Q | R | S |
|-----|-----------|-----------|-----------|-----------|
| (A) | Heat gain | Heat loss | Heat gain | Heat loss |
| (B) | Heat gain | Heat loss | Heat loss | Heat gain |
| (C) | Heat loss | Heat gain | Heat gain | Heat loss |
| (D) | Heat gain | Heat gain | Heat loss | Heat gain |
- (Level-1)

6. Refer to the given figure showing two syringes, X and Y. Syringe X contains 30 cm^3 of air while syringe Y contains 30 cm^3 of water. The ends of both the syringes are sealed and the plungers are then pushed in.



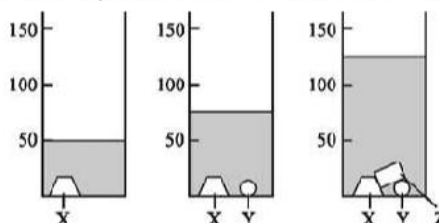
Which of the following graphs correctly represents the volume of air in syringe X and volume of water in syringe Y as the plunger is pushed in?

- (A) (B)

- (C) (D) (Level-1)

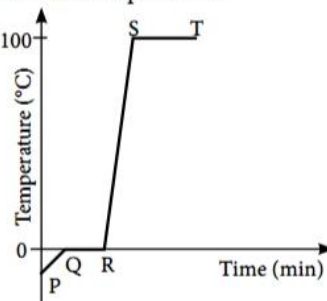
7. Amol has three objects, X, Y and Z. He puts X into a measuring cylinder with 30 mL of water. Then he puts Y and Z one by one into the same measuring cylinder as shown.

Which of the objects has/have a volume less than 30 mL?



- (A) X only (B) Y only
 (C) X and Y only (D) X, Y and Z (Level-1)

8. Refer to the given graph representing changes in the states of water with temperature.

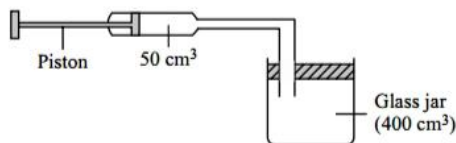


Based on the given graph which of the following statements are correct?

- (i) Heat is gained from P to T.
 (ii) There are different states of water along QR.
 (iii) Vaporisation occurs at P to Q.
 (A) (i) and (ii) only (B) (ii) only
 (C) (ii) and (iii) only (D) (i), (ii) and (iii) (Level-1)

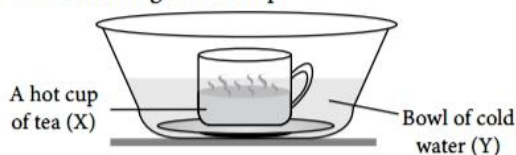
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What is the final volume of air in the jar?



- (A) 50 cm^3 (B) 350 cm^3
 (C) 400 cm^3 (D) 450 cm^3 (Level-1)

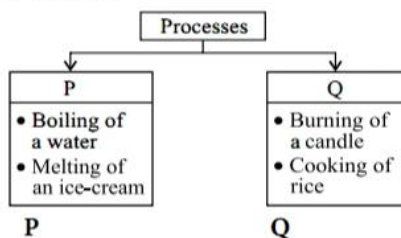
10. Refer to the given set-up.



Which of the following is correct regarding heat loss and heat gain in X and Y?

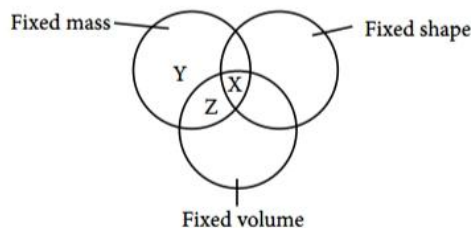
- | X | Y | |
|---------------|-----------|-----------|
| (A) Heat gain | Heat loss | |
| (B) Heat loss | Heat gain | |
| (C) Heat gain | Heat gain | |
| (D) Heat loss | Heat loss | (Level-1) |

11. Mohan grouped a few processes under two different categories 'P' and 'Q' as shown in the given flow chart. Identify 'P' and 'Q'.



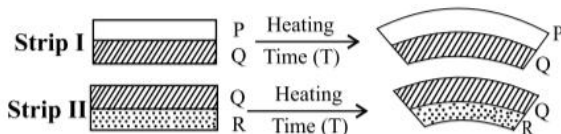
- | | |
|-------------------------|---------------------|
| (A) Physical change | Chemical change |
| (B) Chemical change | Physical change |
| (C) Periodic change | Non periodic change |
| (D) Irreversible change | Reversible change |
- (Level-2)

12. Refer to the given Venn diagram. Identify X, Y and Z and select the correct statement regarding them.



- (A) The process of changing Y into X is called freezing.
 (B) The process of changing X into Y is called sublimation.
 (C) The process of changing Z into X is called evaporation.
 (D) The process of changing Z into X is called condensation.
- (Level-2)

13. Ritu took two bimetallic strips, I and II (of equal size, length and breadth) made up of metals P and Q; and Q and R, respectively as shown in the figure. She subjected each bimetallic strip to heating for the same time period. The given diagram shows her experiment.



Which of the following can be inferred from the given experiment?

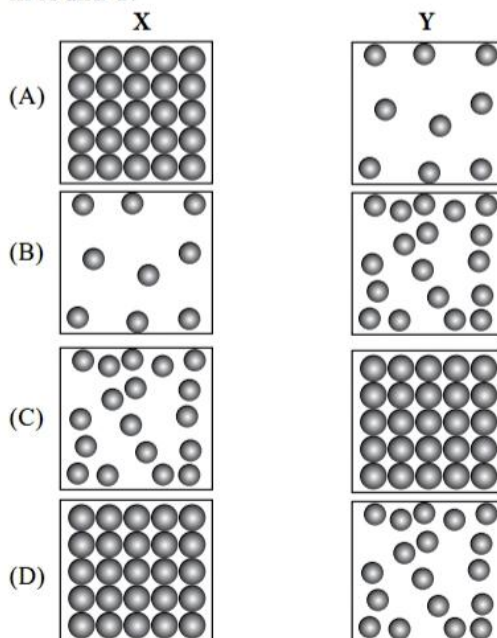
- (A) Metal Q expands more as compared to metals P and R on heating for the same time period.
 (B) Metal R contracts more as compared to metals P and Q on heating for the same time period.
 (C) The order of expansion of these metals when subjected to heating is $R < Q < P$.
 (D) Both (B) and (C)
- (Level-2)

14. Sonia classified different materials based on their properties. Which of the following sets are correctly matched?

Set	Hard	Opaque	Floats on water	Insoluble in water
I	Sponge	Butter paper	Glass marble	Honey
II	Steel	Wooden board	Ice	Mustard oil
III	Iron nail	Glass	Grass	Sugar candy
IV	Lump of sugar	Thermocol	Hair	Glass powder

- (A) II and IV only
 (B) I and II only
 (C) III and IV only
 (D) I, II, III and IV
- (Level-2)

15. X changes to Y on condensation. Select the option that correctly represents the arrangement of molecules in X and Y.



(Level-2)

HINTS & EXPLANATIONS

SELF TEST - 1

1. (B)
2. (C) : Liquids do not have fixed shape. They take the shape of the container in which they are kept.
3. (B)
4. (C) : Paper, wood and cloth are solids while methane is a gas.
5. (D) : Dew is liquid form and water vapour is gaseous form of water. Both liquid and gas do not have definite shape.

SELF TEST - 2

1. (D) : With increase in surface area, wind speed and temperature, the rate of evaporation increases.
2. (D)
3. (A) : Electric cables hang loosely in summer due to expansion. The movement of molecules in a substance increases on heating.
4. (C)
5. (A) : Drying of wet floor involves evaporation of water from the floor.

SELF TEST - 3

1. (C) : Rusting of iron nails, burning of paper and making curd from milk are examples of chemical changes.
2. (B) : Palladium and platinum are solvents while hydrogen is a solute.
3. (A) : Vinegar, ink and lemon juice in water are examples of miscible liquids.
4. (B)
5. (D)

SELF TEST - 4

1. (B) : Glass is a transparent material that allows light to pass through it and thus, we can easily see through it.
2. (D) : Objects that shine are said to have lustre. They shine because of their ability to reflect light. Gold, copper and silver metals have lustre. Wood does not shine, so it does not have lustre.
3. (C) : Key being more dense than water will sink in water.
4. (D) : Rubber and glass do not allow electric current to pass through them, they are insulators.
5. (D) : Silk cloth - Smooth
Wood - Opaque
Eraser - Non-lustrous
Frosted glass - Semi-transparent

EXERCISE

1. (B)
2. (A)
3. (A) : On heating, solubility of a solute increases. Therefore sugar in glass L will dissolve faster.
4. (D) : X could be silver vessel as it is both lustrous and hard while Y could be glass as it is both hard and transparent.
5. (B) : Melting of ice is a physical change and rusting of iron is a chemical change.
6. (C)
7. (D) : Germination of seeds is an example of chemical change. Materials which can be compressed or scratched easily are called soft materials.
8. (A) : Vinegar, lemon juice, milk and fruit juice are miscible with water. Coconut oil and mustard oil are immiscible with water. Sand and chalk powder do not dissolve in water.
9. (C) : X is a frosted glass (translucent material) through which one can see partially. Chart paper and aluminium foil are opaque materials through which one cannot see.
10. (C) : Gas (nitrogen, water vapour and oxygen) neither has definite shape nor definite volume. Liquid (milk, juice, ink, vinegar and oil) has definite volume but no definite shape.
11. (D)
12. (D) : Melting changes water from a state with definite shape and volume (solid) to a state with no definite shape but with definite volume (liquid). Oxygen being a gas can be compressed.
13. (D) : Options (A), (B), (C) and (D) on unscrambling give LUSTROUS, BRITTLE, OPAQUE and INSULATOR respectively.
14. (A) : A substance expands on heating, therefore movement of particles of a substance becomes fast.
15. (B) : Air can be compressed and occupies all the space available to it, so, the final volume of air inside the ball will be 450 cm^3 .
16. (A)
17. (C)
18. (B) : Liquids (milk, apple juice, coffee, salt water and tea) do not have definite shape and cannot be compressed easily. Gases (water vapour, oxygen and nitrogen) do

not have definite shape but can be compressed. Solids (pencil, eraser, cookie and lamp) have definite shape and volume.

19. (B) : Air is present inside the bottle and it occupies space. Therefore, Meera is not able to inflate the balloon inside the bottle.

20. (C) : As material Y did not absorb any water, therefore it is most suitable to make a raincoat.

SOF NSO 2018 QUESTIONS

1. (D) : Air is a mixture of gases and gases are highly compressible.

2. (B) : In the given figure, processes P, Q, R, S and T represent evaporation, condensation, melting, freezing and sublimation respectively. Process P (Evaporation) is involved in obtaining salt from sea water whereas process S (freezing) is involved in formation of ice cube. Process R (melting) is involved in defrosting of refrigerator whereas process P (evaporation) is involved in drying of wet clothes.

3. (D) : Container S will have maximum volume of water after a few hours, because it has minimum surface area for evaporation. Hence, least amount of water will get evaporated from it.

4. (C) : P casts a dark shadow which means light cannot pass through it. Hence, P could be an opaque object, i.e., wood. Q does not cast any shadow, as light

passes through it completely. Hence, Q could be a transparent object. R casts a faint shadow which means light can partially pass through it. Hence, R could be a translucent object, i.e., frosted glass.

5. (B)

6. (B) : As air is highly compressible, therefore its volume will change on pushing the plunger. Water compresses negligibly on pushing the plunger.

7. (C) : When only X is added, volume of water increases 20 mL (from 30 mL to 50 mL) only. When Y is added, water level rises another 25 mL (from 50 mL to 75 mL). Hence, X and Y have a volume less than 30 mL. On the other hand addition of Z increases volume from 75 mL to 125 mL i.e., an increase of 50 mL.

8. (A) : Heat is gained from P to T. P to Q shows solid state of water i.e., ice. Ice changes to water along Q to R. Water gradually heats up and finally boils along S to T, i.e., vaporisation occurs at S to T.

9. (C)

10. (B) : Heat lost by hot tea will be gained by cold water.

11. (A)

12. (B) : In the given Venn diagram, X is solid, Y is gas and Z is liquid.

13. (C) 14. (A)

15. (B) : Water vapour (gas) changes to water (liquid) on condensation.



Force and Energy

Learning objectives

8.1 Force

8.2 Energy

8.3 Simple machines

8.1 FORCE

Force can be defined as the push or pull that tends to maintain or alter the motion of a body in the direction of the force or to distort it. The direction in which the object is pushed or pulled is called the **direction of force**. Push and pull come from the objects interacting with one another. At least two objects must interact with each other for a force to come into play. Forces are used in our everyday activities, *e.g.*, a force is used when we pull a door; a force is used when we twist a wet cloth to squeeze out water, etc.



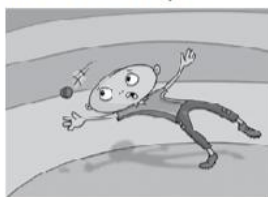
A vendor pushing the cart to make it move

A force can produce the following effects :

- It can move a stationary object.
- It can stop a moving object.
- It can make moving object move faster.
- It can slow down a moving object.
- It can change the direction of a moving object.
- It can change the shape and size of an object.



Force can change the direction of a moving object



Force can stop a moving object



Force can change the shape of an object



Olympiad Bite

- All types of forces can be divided into two main groups contact forces and non-contact forces.
- A force which can be exerted by an object on another object only through physical contact is called a contact force. *E.g.*, muscular and frictional force.
- A force which can be exerted by an object on another object even from a distance, is called non-contact force. *E.g.*, magnetic, electrostatic and gravitational force.

Types of Forces

There are different types of forces present in nature.

Muscular force

The force exerted by muscles of our body is called **muscular force**. Lifting a school bag, kicking a football, pushing a door, etc., are some activities that use muscular force.



Boy using muscular force to kick the football



Man using muscles to lift weight

The strong muscles of a weightlifter enable him to lift weights much heavier than an ordinary person can. A balanced diet, regular exercise and outdoor activities such as running and playing can help us build strong muscles.

Frictional force

A ball rolling on the ground comes to a stop after sometime. The observation indicate the presence of a force that opposes the motion of object. This force that causes moving things to slow down and stop is called **frictional force** or **friction**. It acts opposite to

the direction of the motion of objects. It comes into play only when an object moves or tries to move over a surface. A rough surface offers greater friction than a smooth surface. So, friction can be reduced by making the surfaces smooth.

Advantages of friction

- Friction helps us to walk. If there was no friction, then we would just slip if we tried to walk. When we apply force in the backward direction by our feet, the force of friction acts in the forward direction and helps us to walk forward.
- Without friction, we would not be able to hold anything in our hand. It is the friction between a pen and a paper that allows us to write.
- A pencil eraser uses friction to rub off mistakes.
- The tyres of a car (or any other vehicle) would just keep spinning if there was no friction between the tyres and the road. Car brakes can be applied because of friction.



This boy slips on wet marble floor and falls down due to very small friction

Disadvantages of friction

- Friction makes it difficult to move heavy things across the floor.
- Friction causes the soles of our shoes, the surface of tyres and moving parts of machines to wear out.

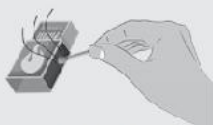
Mechanical force

It is a type of contact force. For example, cranes use mechanical force to tow away a bus, a car or lift heavy loads during the construction of buildings, flyovers and bridges. A pair of scissors applies a mechanical force while cutting a piece of cloth. The engine of a train generates a large mechanical force that enables it to pull the coaches attached to it.



Olympiad Bite

When we rub a matchstick against the rough side of a matchbox, then friction between the head of matchstick and rough side of matchbox produces heat. This heat ignites the chemicals present on the head of matchstick due to which the matchstick lights up. So, the matchstick catches fire and starts burning. The burning of matchstick would not be possible without friction.



Magnetic force

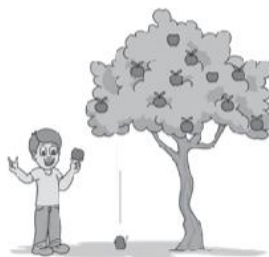
A magnet attracts metals such as iron. The screw is made up of iron. So, when the magnet is moved, the screw follows it. The materials that get attracted to a magnet are called **magnetic materials**. The force exerted by a magnet is called **magnetic force**.



Magnetic force

Gravitational force

The force by which Earth pulls objects towards itself is called **gravitational force**. When ripe fruits are separated from a plant, they do not float around or fly upwards. Instead, they fall down to the ground. Similarly, when a ball is thrown upwards, it comes down after some time.



Apple falls down due to gravitational force

Elastic force

A stretched rubber band regains its original shape on being released because of elastic force. Elastic force arises when a body deforms.

Buoyant force

If we push down a mug or a block of wood floating on water, we feel an upward thrust. The upward push of water on a floating object is called **buoyant force**. This force acts on every object, even on you when you enter a swimming pool.



Plastic ball floating on water

Electrostatic force

Electrostatic forces are attractive or repulsive forces between particles that are caused by the electric charges. An electrically charged object can exert an electrostatic force on an uncharged object. For example, a plastic comb which is electrically charged by rubbing in dry hair, exerts an electrostatic force on uncharged tiny pieces of paper and attracts them.



Plastic comb attracting pieces of paper

SELF TEST - 1

- Which of the following shows an effect of force on an object?
(A) Watching a soccer match
(B) Sleeping on a sofa
(C) Kicking a football
(D) All of these
- Which of the following is not an effect of force?
(A) Moving a stationary object.
(B) Stopping a moving object.
(C) Changing the shape of an object.
(D) None of these
- The force exerted by the action of our muscles is called _____.
(A) Muscular force (B) Elastic force
(C) Buoyant force (D) Magnetic force
- Which of the following is an advantage of frictional force?
(A) It helps us to walk on floor.
(B) It causes wearing and tearing of tires.
(C) It heats up machines.
(D) It wears out the soles of our shoes.
- Astronauts float in space due to absence of
(A) Frictional force (B) Gravitational force
(C) Muscular force (D) Elastic force.

8.2 ENERGY

Energy is the ability to do work. Energy is everywhere in nature – sunlight, wind, water, all posses energy. We use energy every day but we cannot see energy. Only its effects can be seen.

Different Forms of Energy

Mechanical energy

Mechanical energy is the energy which is possessed by an object due to its motion or due to its position. Mechanical energy can be either **kinetic energy** (energy of motion) or **potential energy** (due to its position). A moving car possesses mechanical energy due to its motion (kinetic energy). A drawn bow possesses mechanical energy due to its stretched position (elastic potential energy).



A running car possesses kinetic energy

Heat energy

It is a form of energy which is responsible for the sensation of hotness or coldness. We get heat energy from the Sun and also by burning various fuels like wood and coal. This energy is useful in cooking, running steam engine and generating electricity.



Heat energy

Solar energy

Solar energy is the most readily available source of energy. It is the most important source of energy

because it is non-polluting. When we hang our clothes to dry in the Sun, we use the energy of the Sun. Similarly, solar panels absorb the energy from the Sun to provide heat for cooking.

Light energy

Like heat, light is also a form of energy. It makes things visible to us. It travels as waves. It enables us to see things around us. Light energy can travel through vacuum. The Sun is the main source of light for us. We also get light from stars, bulbs, torches, candles, etc.



Light energy

Electrical energy

Electrical energy is the movement of electrical charges. Electrical charges moving through a wire is called **electricity**. Most of the appliances that we use these days like washing machines, televisions, computers, tubelights, bulbs and fans run on electricity.



Electrical energy is used for running various appliances

Sound energy

Many objects such as musical instruments, firecrackers and aeroplanes produce sound energy. It is produced when force makes an object vibrate. Sound energy travels through solids, liquids and gases as **waves**. It needs medium to travel. It cannot travel through vacuum.



Sound energy

It travels fastest in a solid medium and slowest in a gaseous medium. The energy of sound is far less than other forms of energy.

Geothermal energy

The word geothermal comes from the Greek words geo (Earth) and therme (heat). So, geothermal energy is heat from within the Earth. We can use the steam and hot water produced inside the Earth to heat up rooms or to generate electricity. Geothermal energy is a renewable energy source because the water is replenished by rainfall and the heat is continuously produced inside the Earth.

Hydro energy (water energy)

Hydro energy is the energy obtained from moving water. Earlier people used this energy to move a paddle wheel that would grind the grains. Now, it is also being used to produce electricity, which is known as **hydro electricity**. The power station is called **hydro power station**. It is a renewable and non-polluting source of energy.

Wind energy

Wind energy is plentiful, renewable, widely distributed, clean and non-polluting. Therefore, it is considered by experts to be more environment friendly than many other energy sources. Wind power is the conversion of wind energy into a useful form, such as electricity, using wind turbines.



A windmill is used to generate electricity from wind energy



Olympiad Bite

Energy can neither be created nor it can be destroyed. It can only be converted from one form to another. This is known as law of conservation of energy. For example, when we switch on a ceiling fan, the electric energy gets converted into mechanical energy of fan and a small amount of heat energy.

SELF TEST - 2

- In a hydro power station, electricity is produced by using the energy from _____.
(A) Oil (B) Coal
(C) Moving air (D) Running water
- Sun is the main source of
(A) Light energy (B) Heat energy
(C) Mechanical energy (D) Both (A) and (B).
- A running car possesses
(A) Kinetic energy (B) Potential energy
(C) Wind energy (D) Muscular energy.
- _____ is a push or a pull applied to an object.
(A) Energy (B) Gravity
(C) Force (D) Sound
- _____ is utilised by plants for making food.
(A) Solar energy (B) Electrical energy
(C) Mechanical energy (D) Magnetic energy

8.3 SIMPLE MACHINES

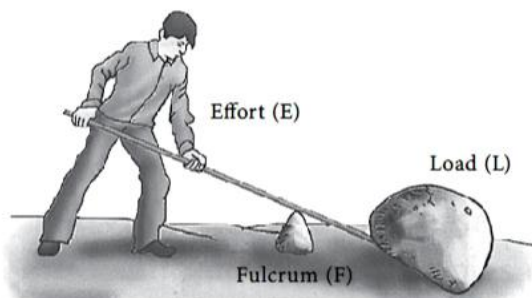
A **machine** is a device or a tool which helps us to do work easily, efficiently and quickly. Some machines have very few parts and a simple structure. They are called **simple machines**. Simple machines do work either by changing the direction of force or by reducing the effort needed. Some examples of simple machines are lever, inclined plane, wheel and axle, pulley and screw.

Lever

A lever is a simple machine consisting of a beam or rigid rod pivoted at a fixed hinge or **fulcrum**. It is free to rotate on fulcrum and is perfect for lifting or moving heavy things.

For example, in order to move a big stone with hands or with the help of a stick, a person needs to apply a lot

of force. But if a small stone is kept as a support below the rod very close to the stone and the person uses a downward force on the other end of the rod, the rock is lifted upwards. Here the rod is a lever. The weight lifted by the person is the **load**. The point of support or the pivot point of the rod where it touches the small stone is the **fulcrum**. The force used is the **effort**.



It travels fastest in a solid medium and slowest in a gaseous medium. The energy of sound is far less than other forms of energy.

Geothermal energy

The word geothermal comes from the Greek words geo (Earth) and therme (heat). So, geothermal energy is heat from within the Earth. We can use the steam and hot water produced inside the Earth to heat up rooms or to generate electricity. Geothermal energy is a renewable energy source because the water is replenished by rainfall and the heat is continuously produced inside the Earth.

Hydro energy (water energy)

Hydro energy is the energy obtained from moving water. Earlier people used this energy to move a paddle wheel that would grind the grains. Now, it is also being used to produce electricity, which is known as **hydro electricity**. The power station is called **hydro power station**. It is a renewable and non-polluting source of energy.

Wind energy

Wind energy is plentiful, renewable, widely distributed, clean and non-polluting. Therefore, it is considered by experts to be more environment friendly than many other energy sources. Wind power is the conversion of wind energy into a useful form, such as electricity, using wind turbines.



A windmill is used to generate electricity from wind energy



Olympiad Bite

Energy can neither be created nor it can be destroyed. It can only be converted from one form to another. This is known as law of conservation of energy. For example, when we switch on a ceiling fan, the electric energy gets converted into mechanical energy of fan and a small amount of heat energy.

SELF TEST - 2

1. In a hydro power station, electricity is produced by using the energy from _____.

- (A) Oil (B) Coal
(C) Moving air (D) Running water

2. Sun is the main source of

- (A) Light energy (B) Heat energy
(C) Mechanical energy (D) Both (A) and (B).

3. A running car possesses

- (A) Kinetic energy (B) Potential energy
(C) Wind energy (D) Muscular energy.

4. _____ is a push or a pull applied to an object.

- (A) Energy (B) Gravity
(C) Force (D) Sound

5. _____ is utilised by plants for making food.

- (A) Solar energy (B) Electrical energy
(C) Mechanical energy (D) Magnetic energy

8.3 SIMPLE MACHINES

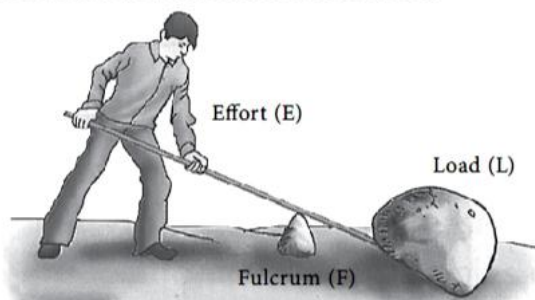
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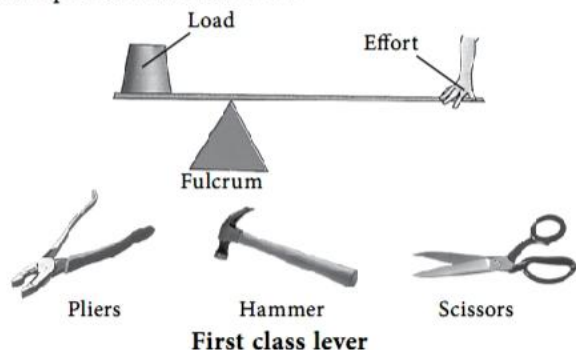
of force. But if a small stone is kept as a support below the rod very close to the stone and the person uses a downward force on the other end of the rod, the rock is lifted upwards. Here the rod is a lever. The weight lifted by the person is the **load**. The point of support or the pivot point of the rod where it touches the small stone is the **fulcrum**. The force used is the **effort**.



Some example of levers that we use in our day-to-day life are hammer, tongs, scissors, pliers and nail-clippers. Levers can be classified according to the position of the fulcrum, load and effort.

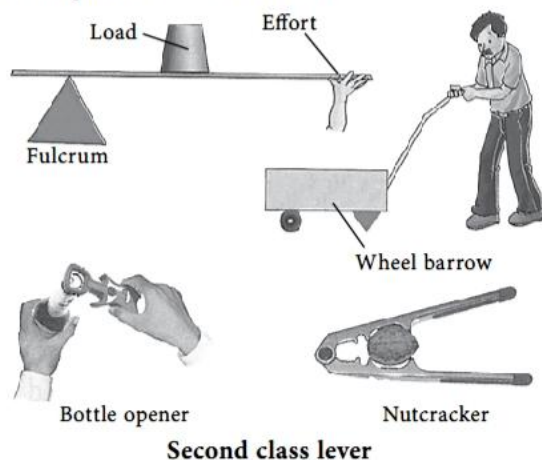
First class lever

In first class lever, the fulcrum is in between the effort and the load. Scissors, crowbar, pliers and see-saw are examples of first class lever.



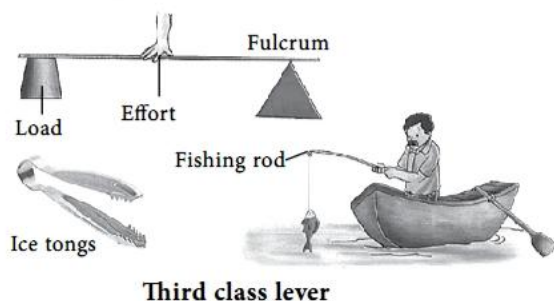
Second class lever

In second class lever, the load is in between the fulcrum and effort. Bottle opener, nutcracker and wheelbarrow are examples of second class lever.



Third class lever

In third class lever, the effort is in between the fulcrum and load. Tongs, tweezers and fishing rods are examples of third class lever.



Pulley

A pulley is a small wheel with a groove around its outer edge. The groove can hold a rope in position. A pulley together with a chain or a rope is used to lift objects.



Water being drawn from a well using a pulley

There are two types of pulleys – fixed pulley and movable pulley.

Fixed pulley

In this type of pulley, the wheel is attached to a hook or a wall and spins at one fixed place. A fixed pulley changes the direction of the force. For example, we can pull down in order to lift something up. It makes lifting objects convenient, but does not reduce our effort. A pulley used to draw water from a well is an example of a **fixed pulley**. In a fixed pulley, the effort should be equal to the load to be lifted.



Movable pulley

In this kind of pulley, the wheel also moves with the load. Here, the effort needed to lift the load is reduced by half. This lets us lift objects that would otherwise be too heavy for us to lift. However, we need to pull twice the length of the rope. Also, the force is applied in the same direction as the load. This means to lift a load, we need to pull the rope in the upward direction. A pulley used to lift heavy engines and fit them into vehicles is an example of a **movable pulley**.



Inclined Plane

An inclined plane is a slope or a slanting surface which connects a lower level to higher level. It helps to move

heavier objects to a height. An inclined plane does not reduce the amount of work done but makes it easier to do. Children's slide in a playground, ramps for wheelchairs and sloping roads are some examples of inclined planes.



Slide in a park



Ramp in a hospital

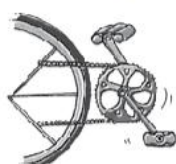
Inclined plane

The Wheel and Axle

A wheel and axle has a large wheel connected to a small rod (axle). The two are fixed so that they move together. When the wheel is turned, the axle also moves. Steering wheel, screwdriver and bicycle pedal are examples of a wheel-axle arrangement.



Screwdriver



Bicycle pedal



Steering wheel

Wheel and axle arrangement

The Screw

A screw is a simple machine used to hold things tightly together. When we join things together with a screw they are held together through a longer distance and thus cannot be forced apart easily. A screw is another type of an inclined plane. It is formed when an inclined plane wraps around a straight rod-like structure. A screw has spirally grooved surface with a pointed end. The head of a screw also has a groove. A screwdriver is fixed into this groove and rotated. Due to spiral grooves, the screw moves into the wood easily. And so, a screw holds the wood more firmly than a nail.



Screw

Wedge

A wedge is an object with two inclined planes ending in a sharp edge. The sharp edge is used to cut materials. Examples of a wedge include razor, axe and knife.



Axe



Razor

Wedge

SELF TEST - 3

1. Which of the following is an example of first class lever?

- (A) Nutcracker (B) Tweezer
(C) Wheelbarrow (D) Scissors

2. Wheel and axle arrangement is found in

- (A) Bicycle (B) Sewing machine
(C) Screwdriver (D) All of these.

3. Examples of wedge include

- (A) Steering wheel (B) Axe

- (C) Razor (D) Both (B) and (C).

4. All are second class lever except

- (A) Bottle opener
(B) Tweezers
(C) Nutcracker
(D) Wheelbarrow.

5. Example of fixed pulley is

- (A) Flagpole (B) Ramp
(C) Crane (D) None of these.

EXERCISE

1. Refer to the given relationship and select the option that satisfies the same relationship.



- (A) Pliers : Hammer : Tweezers
 (B) Hammer : Bottle opener : Tweezers
 (C) Fishing rod : Sea saw : Hammer
 (D) Wheelbarrow : Pliers : Tweezers

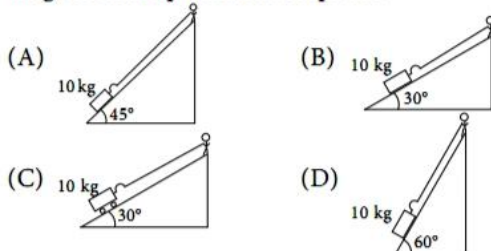
2. Which of the following options shows that force can change the shape of an object?

- (A) Children making toys from clay
 (B) Potter making earthen pots
 (C) A batsman hitting a ball
 (D) Both (A) and (B)

3. Which activity requires a different force than the one involved in rest three activities?

- (A) A plastic ball keeps floating on surface of water kept in a bucket.
 (B) A rolling ball on the floor stops after sometime on its own.
 (C) Wearing and tearing of tyres of an old car.
 (D) Heating up of a mechanical device on its continuous usage.

4. In which of the following cases it would be easier to drag the load up the inclined plane?



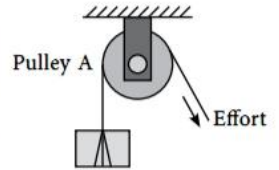
5. Refer to the given picture.

The given device is a (i), it gains (ii) from (iii). (ii) of (i) is then used to generate (iv) that is supplied to residential areas for running electronic devices.



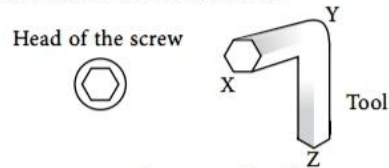
- (A) (i) - Solar panel (ii) - Potential energy (iii) - Wind (iv) - Mechanical energy
 (B) (i) - Windmill (ii) - Light energy (iii) - Sun (iv) - Sound energy
 (C) (i) - Windmill (ii) - Kinetic energy (iii) - Wind (iv) - Electrical energy
 (D) (i) - Solar panel (ii) - Mechanical energy (iii) - Wind (iv) - Geothermal energy

6. Which one of the following actions will cause a decrease in effort needed in using pulley A?



- (A) Increasing the length of the string.
 (B) Tying the load tightly to the string.
 (C) Putting oil in the grooves of the pulley.
 (D) Attaching another fixed pulley to the system.

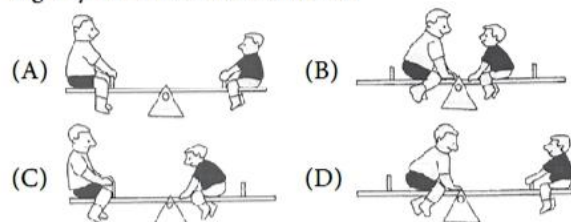
7. The tool shown below is used to screw and unscrew the head of a screw as shown below.



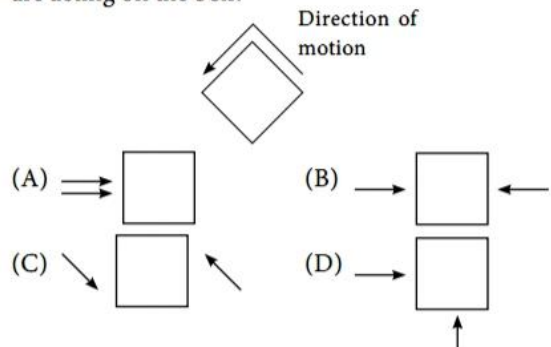
Select the correct option regarding it.

- (A) The given tool belongs to class II lever.
 (B) The given tool is a type of simple machine called screw.
 (C) When force is applied at Z then least effort is used to loosen or tighten the screw.
 (D) Both (B) and (C)

8. The given picture show two boys sitting on a see-saw. The big boy weighs 40 kg while the other one weighs 20 kg. Which of the pictures shows the best way for the big boy to balance the small one?



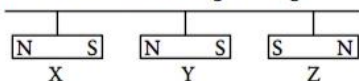
9. When two forces are acting on a box, it turns in the direction as shown in the given figure. Which of the following diagrams correctly shows how the two forces are acting on the box?



10. The given diagram shows a rubber tyre. There are deep treads on the tyre because they
- Increase the stopping distance of the car
 - Reduce the amount of material used
 - Enable the tyre to move smoothly
 - Increase friction.

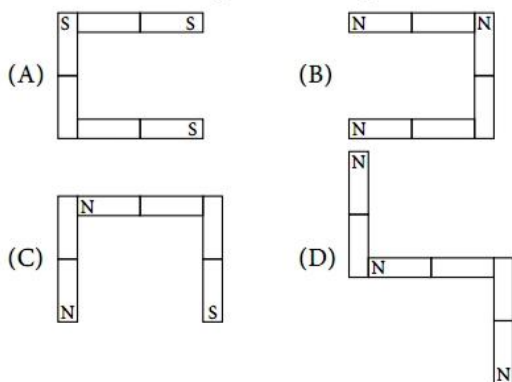


11. What will happen when three bar magnets are hung in the manner as shown in the given figure?

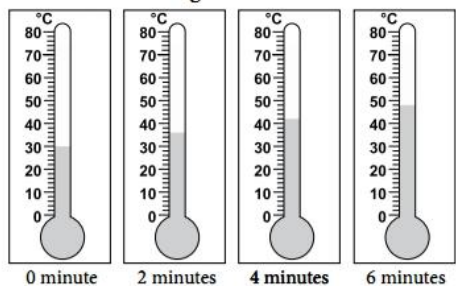


- Nothing will happen.
- Magnet Z will turn round and round.
- Magnet Y will move towards magnet Z.
- Magnet Y will move towards magnet X.

12. Study the arrangement of 3 bar magnets as shown below. Which arrangement is the possible one?



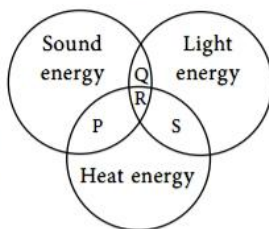
13. A cup of water was heated for six minutes. The given thermometers show the temperature readings during different times of heating.



What can be the temperature when it is heated for five minutes?

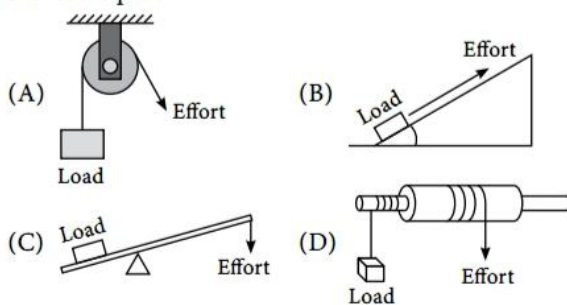
- 37
- 48
- 45
- 42

14. The given Venn diagram is used to classify electrical appliances according to the forms of energy that they convert into from electrical energy, when they are in use. Which of the following best represents a television?



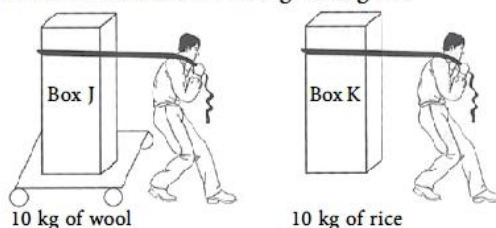
- P
- Q
- R
- S

15. In which of the following machines are the effort and the load equal?



Achievers Section (HOTS)

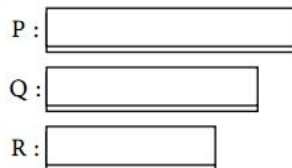
16. Ritesh tried to pull two different boxes filled with different items as shown in the given figure.



He had less difficulty pulling box J than box K. What could the possible reason(s) be?

- The wool is lighter than the rice.
 - There is more friction between box K and the floor.
 - There is more friction between box J and the floor.
- P only
 - P and Q only
 - Q only
 - Q and R only

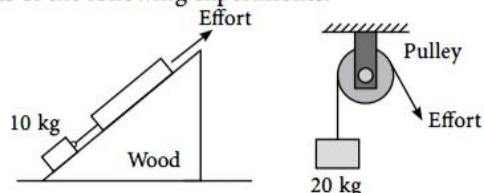
17. Maya carries out an experiment to find out if the length of a ramp affects the effort taken to push a heavy box up a van.



- Which ramp will be the steepest when placed at the same point against the van?
- Which ramp requires Maya to move the box up the van through the longest distance?
- Which ramp helps Maya to move the box with least effort?

- | | X | Y | Z |
|-----|---|---|---|
| (A) | P | Q | R |
| (B) | R | P | P |
| (C) | Q | P | R |
| (D) | P | R | Q |

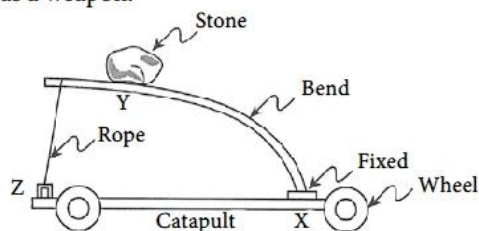
18. Rupesh wanted to study whether more effort is required in using a pulley or a ramp. He compared the results of the following experiments.



Why is this experiment not a fair test?

- He must lift the loads at a different angle.
- He should oil the surfaces of the machine first.
- He must test them at the same time.
- The loads are of different weights.

19. In ancient times, the catapult shown in the figure was used as a weapon.

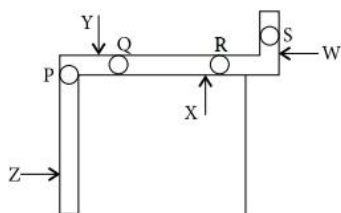


P : Which class of lever is this?

Q : Identify fulcrum, load and effort in the figure.

- | | |
|---------------|-----------------------------|
| P | Q |
| (A) Class I | X-Fulcrum, Y-Load, Z-Effort |
| (B) Class II | X-Effort, Y-Fulcrum, Z-Load |
| (C) Class III | X-Load, Y-Effort, Z-Fulcrum |
| (D) Class II | X-Fulcrum, Y-Load, Z-Effort |

20. The diagram below shows a metal tube with four similar drops of wax attached to position P, Q, R and S on it



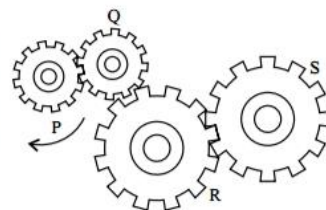
Ravi heated the metal frame at one point on the metal tube and recorded the time taken for the drops of wax to melt in the table below

Position of Wax drops	Time taken for the wax drops to melt (seconds)
P	26
Q	22
R	32
S	40

Based on the results above, at which point (W, X, Y or Z) Ravi heat the metal tube?

- W
- X
- Y
- Z

1. The given diagram shows four gears. Raj applied a force to make the smallest gear P, rotate in a clockwise direction as shown. In which direction will gears Q, R and S rotate?

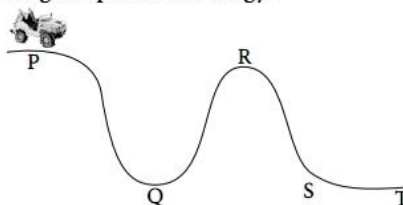


- | | | |
|--------------------|----------------|----------------|
| Q | R | S |
| (A) Anti-clockwise | Anti-clockwise | Clockwise |
| (B) Anti-clockwise | Clockwise | Anti-clockwise |
| (C) Clockwise | Anti-clockwise | Clockwise |
| (D) Clockwise | Anti-clockwise | Anti-clockwise |
- (Level-1)

2. Which of the following is not a first class lever?

- | | |
|-----|-----|
| (A) | (B) |
| (C) | (D) |
- (Level-1)

3. A toy car was placed at the top of a slope and then released. Between which points on the slope did the kinetic energy change to potential energy?



- | | |
|------------|------------|
| (A) P to Q | (B) Q to R |
| (C) R to S | (D) S to T |
- (Level-1)

4. The diagram below shows four beakers P, Q, R and S containing different volumes of water at different temperatures.

Beaker P	Beaker Q	Beaker R	Beaker S
100 mL 70°C	50 mL 90°C	100 mL 90°C	50 mL 70°C

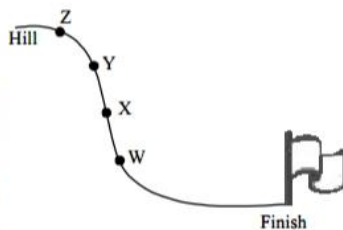
Which one of the following statements is true?

- Beaker P has the most heat energy.
 - Beaker R has more heat energy than beaker Q.
 - Beaker S has more heat energy than beaker R.
 - Beaker P and beaker S have the same amount of heat energy.
- (Level-1)

5. In which of the following levers load lies between the fulcrum and the effort?

- (A) Tweezer (B) Plier
(C) Hammer (D) Nut cracker (Level-1)

6. The given diagram shows a hill with four labelled positions W, X, Y and Z. When a ball is rolled down the hill, then from which position will it finish rolling with the greatest speed?

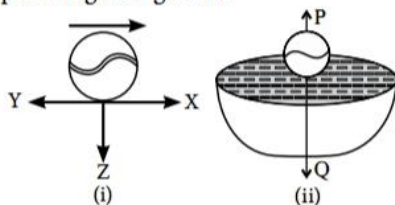


- (A) Position W (B) Position X
(C) Position Y (D) Position Z (Level-1)

7. Force involved in which of the following activities is different from the other three?

- (A) A lift falling freely due to some technical malfunction.
(B) A ball slips from a boy's hand and falls down on the ground.
(C) A girl makes differently shaped toys from pottery clay.
(D) Fruit of climber plant falls on ground when ripe. (Level-1)

8. Refer to the given pictures (i) and (ii) and select the correct option regarding them.



- (A) Force Q and force Z represent the same force.
(B) Force P will be larger when the weight of the object is less.
(C) Force Z and force X act to decrease the speed of the object.
(D) Both (A) and (B) (Level-1)

9. Refer to the given relationship.

Nutcracker : Pliers : Tweezers

Select the option which correctly satisfies the same relationship.

- (A) Wheelbarrow : Crowbar : Tongs
(B) Scissors : Fishing rod : Claw hammer
(C) Bottle opener : Tongs : Scissors
(D) Crowbar : Bottle opener : Fishing rod (Level-1)

10. Shred a paper in tiny pieces. Take a comb and comb your hair. Now bring the comb closer to the paper pieces. What will you observe?

- (A) The paper pieces will get repelled due to magnetic force.
(B) The paper pieces will get repelled due to electrostatic force.

- (C) The paper pieces will get attracted and stick to the comb due to electrostatic force.
(D) The paper pieces will get attracted and stick to the comb due to frictional force. (Level-1)

11. Read the given statements regarding different types of levers and select the correct option.

- (A) In wheelbarrow, fulcrum is in between load and effort.
(B) An ice tong is an example of a second class lever.
(C) In crowbar, the load and effort are at the two ends.
(D) Bottle opener is an example of first class lever. (Level-2)

12. In which of the following cases, the frictional force between the tyres of a car and the road increases?

- (A) When the road is wet.
(B) When the speed of the car increases.
(C) When there are more passengers in the car.
(D) None of these (Level-2)

13. Refer to the given figures and select the correct option regarding these, when they are operating.



- (A) Object I converts mechanical energy into kinetic energy whereas object II converts electrical energy into potential energy.
(B) Object II converts electrical energy into kinetic, heat and sound energy.
(C) Object I converts potential energy into kinetic energy.
(D) Both B and C (Level-2)

14. The given diagram shows three gears arranged to work in a mechanical system. If gear R moves in an anticlockwise direction, in which direction would gears P and Q move?



- (A) P-Anticlockwise, Q-Clockwise
(B) P-Clockwise, Q-Clockwise
(C) P-Clockwise, Q-Anticlockwise
(D) P-Anticlockwise, Q-Anticlockwise (Level-2)

15. Four groups of everyday objects were made by Vanita. Out of these only one group has the same type of machines. Identify this group and select the correct option.

- (A) Lift, escalator, pliers
(B) Nutcracker, wheelbarrow, bottle opener
(C) Door knob, handle of an eggbeater, see saw
(D) Axe, lift, door knob (Level-2)

HINTS & EXPLANATIONS

SELF TEST - 1

1. (C)
2. (D)
3. (A)
4. (A): Without frictional force we will not be able to walk on floor, that is why we often slip on extremely smooth surfaces which offer very less friction.
5. (B): Gravitational force is absent in space.

SELF TEST - 2

1. (D): The energy of running water is used to produce electricity in a hydro power station.
2. (D): Sun is the main source of light and heat energy on Earth.
3. (A)
4. (C)
5. (A): Plants convert solar energy into chemical energy of food during the process called photosynthesis.

SELF TEST - 3

1. (D): Nutcracker and wheel barrow are second class levers, tweezers are third class lever and scissors are first class lever.
2. (D)
3. (D): Steering wheel is an example of the wheel and axle.
4. (B): Tweezers is a third class lever.
5. (A): Ramp is an inclined plane and crane is a movable pulley.

EXERCISE

1. (B): The given analogy refers to first class lever : second class lever : third class lever.
Option (B) satisfies the same relationship as hammer is a first class lever, bottle opener is a second class lever and tweezers belong to third class lever.
2. (D): When children make toys from clay, they force it into different shapes and change its original shape. Similarly a potter makes earthen pots by applying force on clay kept on potter's wheel from different directions.
3. (A): A plastic ball keeps on floating on water surface as it is continuously acted upon by buoyant force of water, i.e., the upward push of water. The force involved in rest of the three activities is frictional force.

Friction is responsible for stopping or slowing down any moving object in contact with a surface as it always acts in direction opposite to the direction of motion. It is also responsible for wearing and tearing of tyres and heating up of a mechanical device.

4. (C): The lesser the inclination of a sloping surface the easier it is to push or pull or drag a weight along it. Option (B) and (C) show an inclined plane which has lesser angle of inclination. It will be more easier to drag a load along inclined plane in option (C) as here opposing frictional force is reduced due to presence of wheels as compared to option (B) where surface of contact between load and inclined plane is much more and hence magnitude of friction acting here is also more.
5. (C): The given picture is of a windmill. It gains kinetic energy from moving air or wind. The kinetic energy of windmill is used to generate electricity that is supplied to the residential areas for running electronic devices.
6. (C): Putting oil in the grooves of pulley A will reduce the opposing frictional force and hence will cause a decrease in the effort needed in using pulley A.
7. (D): The given tool belong to a simple machine called screw. When force is applied at Z then least effort is required to loosen and tighten the screw.
8. (D)
9. (C)
10. (D)
11. (D): Opposite poles of magnet attract each other and same poles repel each other. In the given set up opposite poles of magnets X and Y are placed side by side so they will attract each other whereas similar poles of magnets Y and Z are placed side by side so they will repel each other. As magnet Y is attracted by magnet X and repelled by magnet Z so it move towards magnet X.
12. (C): Magnets can be arranged attached to one another forming different shapes only when their opposite poles are in contact because opposite poles (North and South) attract each other.
13. (C): Given figures show that temperature is 36°C at 2 min, 42°C at 4 min and 48°C at 6 min.
For each minute, there is an increase of 3°C
 $\therefore$ for 5 min, temperature = $42^{\circ}\text{C} + 3^{\circ}\text{C} = 45^{\circ}\text{C}$
14. (C)

15. (A)

16. (C) : Both the boxes are equal in weight but box J is placed on a plank provided with wheel so the frictional force operating here is less as compared to box K. So it will be easier for Ritesh to drag box J as compared to box K.

17. (B) : Longest ramp when placed against van will have least inclination. Lesser the inclination of ramp easier it is to drag weight along it. As P ramp is longest, it will be least inclined when placed against van whereas R ramp is shortest. So R ramp will have highest inclination and so ramp P will require least effort by Maya to move the box and ramp R will require most effort by Maya to move the box.

18. (D)

19. (D) : The load is between the fulcrum and the effort. So, it is an example of third class lever.

20. (C)

SOF NSO 2018 QUESTIONS

1. (B) : Gears move in opposite direction to the adjacent gear. Therefore, if P is rotating clockwise, Q would rotate anticlockwise, R would rotate clockwise and S would rotate anticlockwise.

2. (A) : Among the given items, tweezer is a third class lever *i.e.*, the effort is located between fulcrum and load. All the rest are first class levers.

3. (B)

4. (B) : The heat energy present in the beaker depends upon (i) the amount of water present in it, and (ii) the temperature of the water. As the highest amount of water at the highest temperature is present in beaker R, thus beaker R, will have the highest amount of heat energy.

5. (D) : In second class lever, the load is between the fulcrum and the effort. Nut cracker is a second class lever. Plier and hammer are first class lever. Tweezer is third class lever.

6. (A) : At position Z the ball has potential energy (energy that an object has due to its position). When it starts rolling down, the potential energy changes

into kinetic energy (energy that an object has due to its movement) and at point W, it will have maximum kinetic energy as compared to points Y and X and thus from this position, it will finish rolling with the greatest speed.

7. (C) : In option C, the girl is applying muscular force to make different shaped toys from pottery clay. The force, exerted by the muscles of the body is called muscular force. The other options are describing the effects of gravitational force.

8. (A) : In the picture (i), X is pushing force, Y is frictional force and Z is gravitational force that act on the ball.

In picture (ii), P is buoyant force and Q is gravitational force. Buoyant force is proportional to the weight of the object.

9. (A) : In the given relationship, nutcracker is a second class lever, pliers is a first class lever and tweezers is a third class lever. Similarly, wheelbarrow is a second class lever, crowbar is a first class lever and tongs is a third class lever.

10. (C) : The force exerted by an electrically charged object is called electrostatic force. The plastic comb is electrically charged by rubbing in dry hair and exerts an electrostatic force on uncharged tiny pieces of paper and attracts them.

11. (C) : Crowbar is an example of first class lever. In first class lever, the fulcrum is between the load and the effort. In wheelbarrow, load is in between fulcrum and effort. Ice tong and bottle opener are third class and second class lever respectively.

12. (C)

13. (D)

14. (B) : Gears more in opposite direction to adjacent gear. Therefore, if R is rotating in an anticlockwise direction, then both P and Q would rotate in clockwise direction.

15. (B) : Nutcracker, wheelbarrow and bottle opener are second class levers.



CLASS
5

MTP
1



**SOF NATIONAL SCIENCE
OLYMPIAD**

GUIDELINES FOR THE CANDIDATE

Total Questions : 50 | Time: 1 hr.

1. You will get additional ten minutes to fill up information about yourself on the OMR Sheet, before the start of the exam.
2. Write your **Name, School Code, Class, Section, Roll No.** and **Mobile Number** clearly on the **OMR Sheet** and do not forget to sign it. We will share your marks / result and other information related to SOF exams on your mobile number.
3. The Question Paper comprises three sections:
Logical Reasoning (10 Questions), **Science** (35 Questions) and **Achievers Section** (5 Questions)
Each question in Achievers Section carries 3 marks, whereas all other questions carry one mark each.
4. All questions are compulsory. There is no negative marking. Use of calculator is not permitted.
5. There is only ONE correct answer. Choose only ONE option for an answer.
6. To mark your choice of answers by darkening the circles on the OMR Sheet, use **HB Pencil** or **Blue / Black ball point pen** only. E.g.

Q.16 : Raj goes to school on a bicycle. Which of these safety rules he should follow?

- A. He should give signals before taking turns.
- B. He should keep to the right of the road.
- C. He should cross the road by using zebra crossing.
- D. All of these

As the correct answer is option A, you must darken the circle corresponding to option A on the OMR Sheet.

16. ● (B) (C) (D)

7. Return the OMR Sheet to the invigilator at the end of the exam.



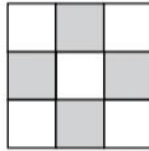
Name:.....

Section:..... SOF Olympiad Roll No.:..... Contact No.:.....

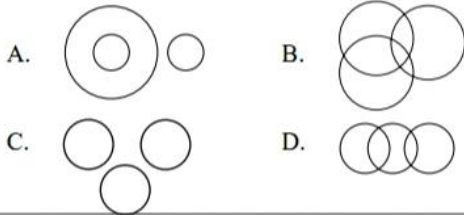
LOGICAL REASONING

1. How many lines of symmetry does the given figure have?

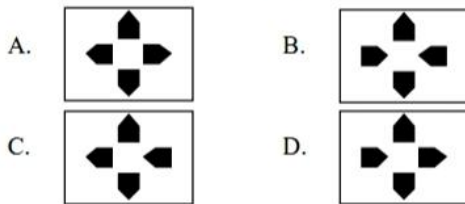
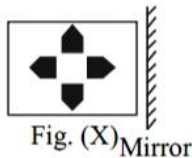
A. 2
B. 1
C. 6
D. 4



2. Which of the following Venn diagrams best represents the relationship amongst, "Sun, Moon and Earth"?



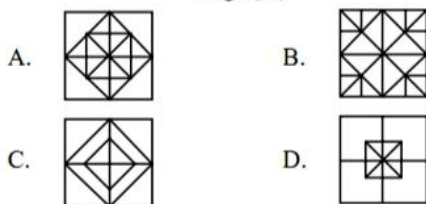
3. Find the correct mirror image of Fig. (X).



4. Find the odd one out.

A. 23
B. 21
C. 35
D. 51

5. In which of the following options, Fig. (X) is exactly embedded as one of its parts?



6. Which of the following letters/numbers is exactly in the middle of 11th letter/number from the right end and 9th letter/number from the left end in the given arrangement?

3 8 D J H 1 4 Q D K V T 6 2 P W C N A T S 4 Z R 9

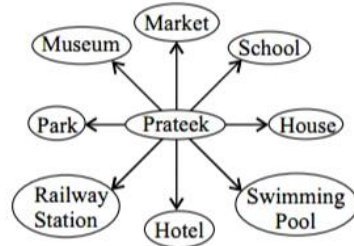
A. T B. 2
C. 6 D. V

7. Which of the following words cannot be formed from the letters of the given word?

INDEPENDENCE

A. PEN B. DEPEND
C. NEST D. NICE

8. Prateek is facing the school and turns 135° in anticlockwise direction. What will he be facing now?



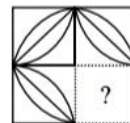
A. Park B. Museum
C. Swimming Pool D. Hotel

9. How many different possible combinations of one pencil and one eraser can be formed from the given pencils and erasers?

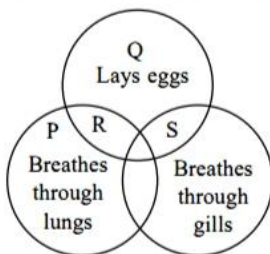
A. 36
B. 60
C. 50
D. 30



10. Select a figure from the options, which when placed in the blank space of Fig. (X) would complete the pattern.

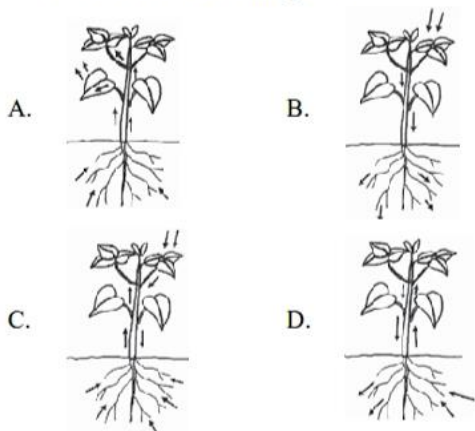


11. Study the given Venn diagram carefully.



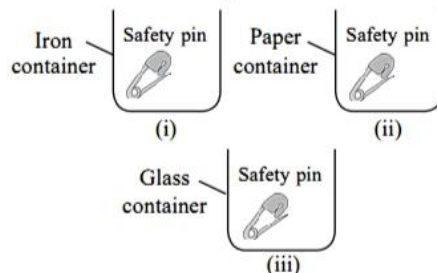
Which alphabet represents prawn?

- A. R B. S
C. Q D. P
12. Select the correct pair of deficiency disease and its symptom from the following options.
- A. Beriberi - Swelling in neck
B. Scurvy - Nerve disorder
C. Rickets - Soft bones
D. Anaemia - Bleeding gums
13. Which of the following sets of gases do not contribute to global warming?
- A. Carbon dioxide and nitrous oxide
B. Oxygen and nitrogen
C. CFC and carbon dioxide
D. Methane and water vapour
14. Which of the following could be the result, when a river rises above its bank due to heavy rainfall?
- A. Hurricane B. Tsunami
C. Cyclone D. Flood
15. Which of the following figures correctly shows the movement of water in the plant?



16. Krishna dropped a piece of stone and one teaspoon of sugar into a beaker containing water. He noticed that after sometime only the stone remained at the bottom. Which of the following conclusions can be made by Krishna?
- A. Sugar is soluble and heavier than water whereas stone is insoluble and lighter.
B. Sugar is soluble and lighter than water whereas stone is insoluble and heavier.
C. Both sugar and stone are heavier than water. However, sugar is soluble whereas stone is not.
D. Both sugar and stone are lighter than water. However, sugar is soluble whereas stone is not.

17. In which of the following set-ups Neetu will be able to remove the safety pin by using a magnet on the outer surface of the respective containers?

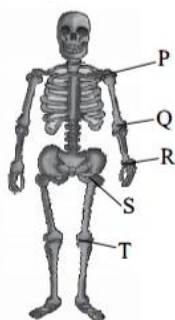


- A. (i), (ii) and (iii) B. (ii) and (iii) only
C. (i) and (iii) only D. (ii) only
18. Which among the following represents first class lever?
- A. B.
C. D. Both A and B
19. Select the characteristic which is not common to the given animal group.



- A. They all breathe through lungs.
B. They have hair on their body.
C. Internal fertilization takes place in them.
D. They all give birth to young ones.

20. Ball and socket joint allows the free movement of some body parts in almost any direction. Identify the ball and socket joints in the given diagram.



- A. P and R B. Q and T
C. R and S D. P and S

21. Select the seed which gets dispersed by the same agent as seed X.



- A. B.
C. D.

22. The Red Fort of Delhi and the Agra Fort are made up of _____.

- A. Granite B. Marble
C. Sandstone D. Conglomerate

23. Roshni described an animal as shown in the given figure.

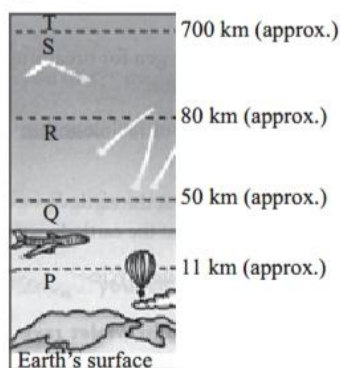
Description

- Lays 120 to 150 eggs on garbage.
- Life span is about 28 days.
- Spreads diseases such as cholera, typhoid, diarrhoea, etc.

Which of the following animal is she talking about?

- A. B.
C. D. None of these

24. Study the given figure showing different layers of the atmosphere and select the correct statement regarding P, Q, R, S and T.



- A. Layer R prevents meteorites from reaching the earth's surface by burning them.
B. Layer P helps in the long distance communication through radio, mobiles, etc.
C. All the weather changes take place in the layer T.
D. Layer R contains ozone gas which prevents harmful UV rays from reaching the earth's surface.

25. Match column I with column II and select the correct option from the codes given below.

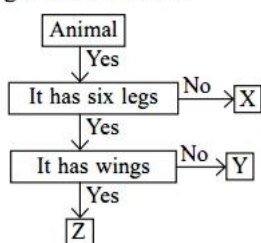
Column I

Column II

- (a) (i) Wedge
(b) (ii) Inclined plane
(c) (iii) Wheel and axle
(d) (iv) Pulley

- A. (a) - (ii), (b) - (iii), (c) - (i), (d) - (iv)
B. (a) - (ii), (b) - (iii), (c) - (iv), (d) - (i)
C. (a) - (ii), (b) - (iv), (c) - (iii), (d) - (i)
D. (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)

26. Study the given flow chart.



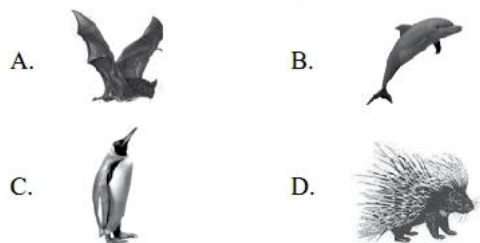
Select the option that correctly identifies X, Y and Z.

	X	Y	Z
A.	Grasshopper	Ant	Bedbug
B.	Cockroach	Bedbug	Grasshopper
C.	Spider	Silver fish	Butterfly
D.	Housefly	Mosquito	Locust

27. Identify the group of diseases which can spread from one person to another.

- Malaria, Anaemia and Cholera
- Typhoid, Common cold and Rickets
- Amoebic dysentery, Goitre and Malaria
- Measles, Chicken pox and Plague

28. Which one of the following is not a mammal?



29. Refer to the given figures.



Select the option in which same part is edible as in P, Q and R.

	P	Q	R
A.	Onion	Ginger	Mango
B.	Broccoli	Carrot	Onion
C.	Tomato	Turnip	Sugarcane
D.	Cauliflower	Onion	Ginger

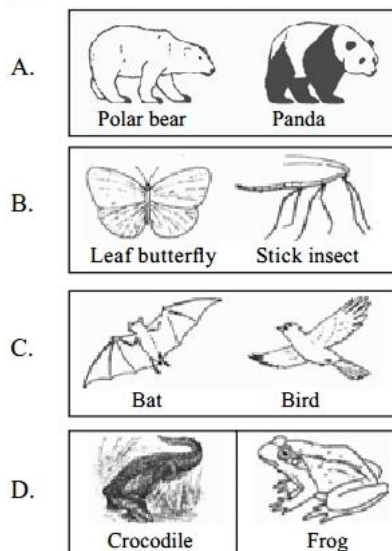
30. Read the given statements and select the correct option.

Statement 1 : Vehicular exhausts cause a number of deadly diseases such as lung cancer and asthma.

Statement 2 : Harmful gases released from vehicles, degrade the air quality.

- Both statements 1 and 2 are true and statement 2 is the correct explanation of statement 1.
- Both statements 1 and 2 are true but statement 2 is not the correct explanation of statement 1.
- Statement 1 is true but statement 2 is false.
- Both statements 1 and 2 are false.

31. Which of the following groups of animals does not possess vertebral column?



32. Which of the following is/are the function(s) of the part labelled as X in the given figure?

- To absorb water from the soil.
- To transport food to all parts of the plant.
- To transport water to all parts of the plant.
- To hold the plant upright to receive sunlight.

- (i) only
- (iv) only
- (i) and (ii) only
- (ii), (iii) and (iv) only



33. Refer to the given figure showing layers of soil and select the incorrect option regarding them.

- Plants grow well in layer P.
- Layer Q is also known as bed rock, as it contains large pieces of rocks.
- Layer R is also known as subsoil, it contains very less quantity of organic matter.
- Both B and C



34. X is used to detect the direction, duration, etc. of earthquake whereas Y is used to measure the magnitude of the earthquakes.

Which of the following correctly identifies X and Y.

X	Y
A. Seismometer	Richter scale
B. Richter scale	Seismometer
C. Seismograph	Seismometer
D. Richter scale	Seismograph

35. Jaanvi was asked to write the names of some igneous rocks but she wrote the names of some metamorphic and sedimentary rocks also as given in the box below.

Coal, Limestone, Granite, Marble, Pumice, Slate, Quartzite, Shale, Basalt

Select the option which correctly identifies the igneous rocks.

- A. Granite, Pumice, Basalt
B. Marble, Slate, Quartzite
C. Limestone, Marble, Slate
D. Coal, Shale, Limestone

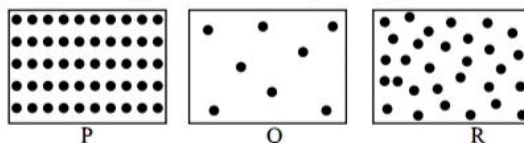
36. Match column I with column II and select the correct option from the codes given below.

Column I	Column II
(a) Volcano	(i) Disturbance in Earth's layers
(b) Tsunami	(ii) Strong storm with fast spinning winds
(c) Earthquake	(iii) Release of hot molten rock
(d) Cyclone	(iv) Disturbance on sea bed or ocean floor
A. (a) - (iii), (b) - (iv), (c) - (i), (d) - (ii)	
B. (a) - (iii), (b) - (i), (c) - (iv), (d) - (ii)	
C. (a) - (ii), (b) - (iv), (c) - (i), (d) - (iii)	
D. (a) - (iii), (b) - (iv), (c) - (ii), (d) - (i)	

37. Fill in the blanks with the most appropriate option. Volcanoes are cracks in the Earth's crust out of which molten (i) comes out. This (i) comes from the (ii) of the Earth. The molten rock rushes out through a vertical tunnel called (iii) and fills a hollow (iv) at the top. The hot (i) on reaching the Earth's surface is called (v).

	(i)	(ii)	(iii)	(iv)	(v)
A.	Magma	Crust	Vent	Crater	Lava
B.	Magma	Mantle	Vent	Crater	Lava
C.	Lava	Mantle	Crater	Vent	Magma
D.	Lava	Crust	Vent	Crater	Magma

38. Which figures best represent molecules of matter in solid and gaseous state respectively?



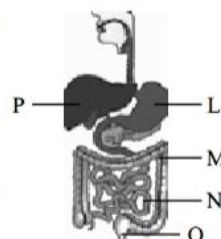
- A. P and Q
B. R and Q
C. P and R
D. Q and P

39. Match the figures in column I with the energy conversions in column II and select the correct option from the codes given below.

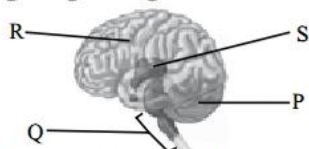
Column I	Column II
(a) 	(i) Chemical energy to kinetic energy
(b) 	(ii) Electrical energy to light energy
(c) 	(iii) Electrical energy to heat energy
(d) 	(iv) Wind energy to electrical energy
A. (a) - (i), (b) - (ii), (c) - (iii), (d) - (iv)	
B. (a) - (iv), (b) - (ii), (c) - (i), (d) - (iii)	
C. (a) - (iv), (b) - (iii), (c) - (ii), (d) - (i)	
D. (a) - (i), (b) - (ii), (c) - (iv), (d) - (iii)	

40. Study the given diagram of human digestive system and select the correct option regarding organ P.

- A. It helps in the digestion of food.
B. It helps in supplying oxygen to the body parts.
C. It is the largest gland of human body.
D. Both A and C



41. Which of the following statements is incorrect regarding the given figure?



- A. P helps to balance our body.
B. S controls breathing.
C. Q controls involuntary actions of our body.
D. R controls our thinking, learning, memory and senses.

42. In which of the following conditions, seed will germinate? (✓ represents presence and ✗ represents absence.)

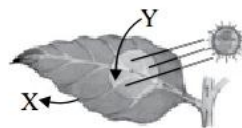
	Air	Warmth	Water	Sunlight
A.	✓	✓	✗	✓
B.	✗	✓	✓	✓
C.	✓	✓	✓	✗
D.	✗	✗	✓	✓

43. Oil spills in water bodies result in _____.

- A. Global warming

- B. Acid rain
C. Ozone layer depletion
D. Killing of aquatic animals

44. The given figure shows the process of photosynthesis in a leaf. Identify 'X'.



- A. Carbon dioxide B. Nitrogen
C. Oxygen D. Hydrogen

45. Read the following statements about our solar system and select the incorrect one.

- A. Solar eclipse occurs when the shadow of the Moon falls on the Earth.
B. Lunar eclipse occurs when the shadow of the Earth falls on the Moon.
C. The Moon has an atmosphere containing different gases.
D. Gravity of the Moon is about $1/6^{\text{th}}$ of that of the Earth.

ACHIEVERS SECTION

46. Match column I with column II and select the correct option from the codes given below.

Column I	Column II
(a) Root	(i) Turmeric
(b) Stem	(ii) Cabbage
(c) Leaves	(iii) Pumpkin
(d) Fruits	(iv) Turnip
A.	(a)-(i), (b)-(iv), (c)-(ii), (d)-(iii)
B.	(a)-(i), (b)-(iv), (c)-(iii), (d)-(ii)
C.	(a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)
D.	(a)-(iv), (b)-(i), (c)-(iii), (d)-(ii)

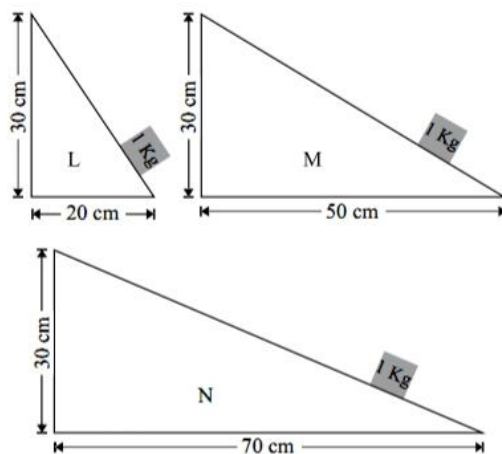
47. Select a healthy potted plant with plenty of leaves. Cover the plant with a transparent polythene bag and tie it tightly around the stem. Place this plant in a lighted area.

What will you observe the next day?

- A. All the leaves are shed
B. Water drops are seen inside the polythene
C. Leaves become pale
D. No changes are seen



48. Seema set up 3 systems as shown below. Each system comprises of an inclined plane and a load (1 kg) which is to be lifted up the inclined plane.



Which out of the given systems requires the least effort to move the load up the inclined plane?

- A. System L
B. System M
C. System N
D. All the systems will require same effort.

49. Which property of air makes drinking through straw possible?

- A. Air has mass.
- B. Air occupies space.
- C. Air exerts pressure.
- D. Air can be compressed.

50. Shweta and Tanvi are investigating what happens when they add sugar to water at different temperatures. They added 10 gms of sugar to 50 ml of water at 10°C, 25°C and 40°C temperature, and recorded how long does it take for the sugar to dissolve. Following table was made by them.

Temperature	10° C	25° C	40° C
Time taken for the sugar to dissolve	120 Seconds	80 Seconds	50 Seconds

What inference can be drawn from the above table?

- A. Solubility of sugar increases with the increase in temperature.
- B. Solubility of sugar decreases with the increase in temperature.
- C. Solubility of sugar is not affected by change of temperature.
- D. None of these

SPACE FOR ROUGH WORK

Darken your choice with HB Pencil

1.	(A) (B) (C) (D)	14.	(A) (B) (C) (D)	27.	(A) (B) (C) (D)	40.	(A) (B) (C) (D)
2.	(A) (B) (C) (D)	15.	(A) (B) (C) (D)	28.	(A) (B) (C) (D)	41.	(A) (B) (C) (D)
3.	(A) (B) (C) (D)	16.	(A) (B) (C) (D)	29.	(A) (B) (C) (D)	42.	(A) (B) (C) (D)
4.	(A) (B) (C) (D)	17.	(A) (B) (C) (D)	30.	(A) (B) (C) (D)	43.	(A) (B) (C) (D)
5.	(A) (B) (C) (D)	18.	(A) (B) (C) (D)	31.	(A) (B) (C) (D)	44.	(A) (B) (C) (D)
6.	(A) (B) (C) (D)	19.	(A) (B) (C) (D)	32.	(A) (B) (C) (D)	45.	(A) (B) (C) (D)
7.	(A) (B) (C) (D)	20.	(A) (B) (C) (D)	33.	(A) (B) (C) (D)	46.	(A) (B) (C) (D)
8.	(A) (B) (C) (D)	21.	(A) (B) (C) (D)	34.	(A) (B) (C) (D)	47.	(A) (B) (C) (D)
9.	(A) (B) (C) (D)	22.	(A) (B) (C) (D)	35.	(A) (B) (C) (D)	48.	(A) (B) (C) (D)
10.	(A) (B) (C) (D)	23.	(A) (B) (C) (D)	36.	(A) (B) (C) (D)	49.	(A) (B) (C) (D)
11.	(A) (B) (C) (D)	24.	(A) (B) (C) (D)	37.	(A) (B) (C) (D)	50.	(A) (B) (C) (D)
12.	(A) (B) (C) (D)	25.	(A) (B) (C) (D)	38.	(A) (B) (C) (D)		
13.	(A) (B) (C) (D)	26.	(A) (B) (C) (D)	39.	(A) (B) (C) (D)		

ANSWER KEY

- | | | | | | | | | | |
|------|------|------|------|------|------|------|------|------|-------|
| 1. D | 2. C | 3. A | 4. A | 5. A | 6. A | 7. C | 8. A | 9. D | 10. A | 11. B | 12. C | 13. B | 14. D | 15. A | 16. A | 17. A | 18. A | 19. D | 20. D | 21. C | 22. C | 23. A | 24. A | 25. C | 26. C | 27. D | 28. C | 29. A | 30. A | 31. B | 32. D | 33. D | 34. A | 35. D | 36. A | 37. B | 38. A | 39. B | 40. D | 41. C | 42. C | 43. D | 44. C | 45. C | 46. C | 47. B | 48. C | 49. C | 50. A |
|------|------|------|------|------|------|------|------|------|-------|

CLASS
5

MTP
2



SOF NATIONAL SCIENCE
OLYMPIAD

GUIDELINES FOR THE CANDIDATE

Total Questions : 50 | Time: 1 hr.

1. You will get additional ten minutes to fill up information about yourself on the OMR Sheet, before the start of the exam.
2. Write your **Name, School Code, Class, Section, Roll No.** and **Mobile Number** clearly on the **OMR Sheet** and do not forget to sign it. We will share your marks / result and other information related to SOF exams on your mobile number.
3. The Question Paper comprises three sections:
Logical Reasoning (10 Questions), **Science** (35 Questions) and **Achievers Section** (5 Questions)
Each question in Achievers Section carries 3 marks, whereas all other questions carry one mark each.
4. All questions are compulsory. There is no negative marking. Use of calculator is not permitted.
5. There is only ONE correct answer. Choose only ONE option for an answer.
6. To mark your choice of answers by darkening the circles on the OMR Sheet, use **HB Pencil** or **Blue / Black ball point pen** only. E.g.

Q.16 : Raj goes to school on a bicycle. Which of these safety rules he should follow?

- A. He should give signals before taking turns.
- B. He should keep to the right of the road.
- C. He should cross the road by using zebra crossing.
- D. All of these

As the correct answer is option A, you must darken the circle corresponding to option A on the OMR Sheet.

16. ● (B) (C) (D)

7. Return the OMR Sheet to the invigilator at the end of the exam.



Inspiring Young Minds Through Knowledge Olympiads

Name:.....

Section:..... SOF Olympiad Roll No.:..... Contact No.:.....

LOGICAL REASONING

1. Select the odd one out.

A. UTVW B. NMOP
C. KJLM D. CDEF

2. Find the combination of numbers so that the letters are arranged accordingly to form a meaningful word.

O	H	D	A	S	W
1	2	3	4	5	6

A. 5, 4, 1, 2, 6, 3 B. 4, 2, 6, 3, 1, 5
C. 5, 2, 4, 3, 1, 6 D. 2, 4, 3, 6, 1, 5

3. Find the missing number, if same rule is followed in all the three figures.

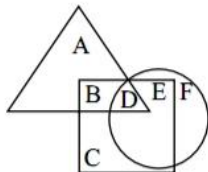
25 14 207	16 12 152	25 18 247
12 15	10 17	21 (?)

A. 15 B. 25
C. 12 D. 16

4. A man starts walking towards North. After walking 10 m, he turns right and after walking 15 m, he again turns right. In which direction is he walking now?

A. North B. South
C. East D. West

5. In the given Venn diagram, the triangle represents 'girls', the square represents 'sports persons' and the circle represents 'coaches'. The region in the figure which represents girls, who are sports persons but not coaches is labelled as _____.



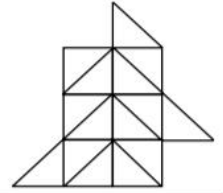
A. A B. B
C. C D. E

6. If 'Book' means 'Watch', 'Watch' means 'Bag', 'Bag' means 'Pen' and 'Pen' means 'Pencil', then what is used to read time?

A. Book B. Watch
C. Bag D. Pen

7. Find the number of triangles formed in the given figure.

A. 18
B. 16
C. 15
D. None of these



8. Select a figure from the options which is the correct mirror image of Fig. (X), if the mirror is placed vertically to the right.

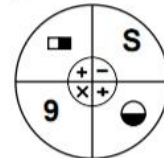
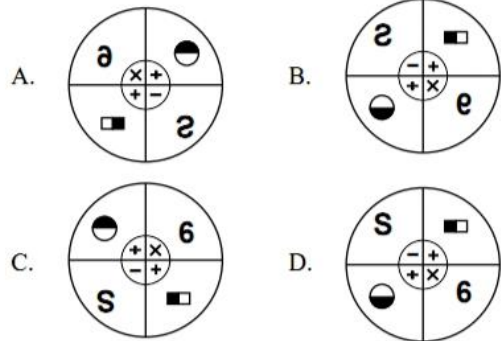


Fig. (X)



9. Study the following arrangement carefully and answer the following question:

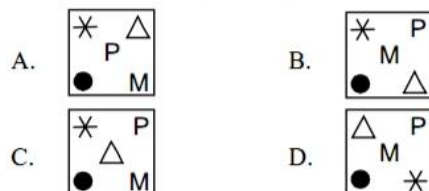
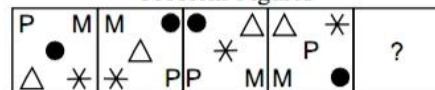
M N 2 3 P @ # 7 5 K U % * J 8 \$ © 4 0

Which of the following is exactly in the middle of @ and \$ in the given arrangement?

A. K B. %
C. U D. 5

10. Select a figure from the options which will replace the (?) to form the series as established by the Problem Figures.

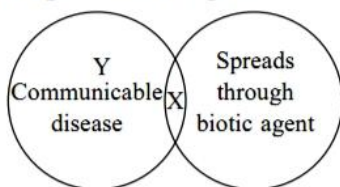
Problem Figures



11. X migrates from sea to freshwater to breed and Y migrates from freshwater to sea to breed. Select the option which correctly identifies X and Y.

X	Y
A. Whale	Shark
B. Eel	Salmon
C. Salmon	Eel
D. Locust	Arctic tern

12. Study the given Venn diagram.



Select the option that correctly identifies X and Y.

X	Y
A. Jaundice	Rickets
B. Dengue	Measles
C. Chickenpox	Scurvy
D. Typhoid	Plague

13. Rahul heated a piece of metal made up of metal P and metal Q. After few minutes, he observed that it curled as shown. What can be concluded from this experiment ?



- A. Metal Q expands less than metal P.
 B. Metal P expands less than metal Q.
 C. Metal P expands and metal Q contracts.
 D. Metal Q expands and metal P contracts.
14. Madhu was asked to write names of some Rabi crops but she wrote names of some kharif crops with them. Identify the names of kharif crops written by Madhu from the following list and select the correct option.

Wheat, Rice, Mustard, Maize, Gram

- A. Wheat, mustard, legumes
 B. Rice, maize
 C. Rice, wheat
 D. Mustard, maize, gram

15. Select the incorrect statement about coal.

- A. It is a kind of igneous rock.
 B. It has a lot of carbon in it and is used as fuel.
 C. It is made of plant remains that have been buried long ago.
 D. It is used in thermal power plants to generate electricity.

16. Study the conversation cited below.

Vidya: L represents the volcanoes that have not erupted since a long time, can erupt in the future but at the moment these are in a state of sleep.

Kirti: M represents the volcanoes that have erupted in the last 10,000 years and can erupt again any time.

Chandni: N represents the volcanoes that have been inactive for thousands of years and are not expected to erupt again.

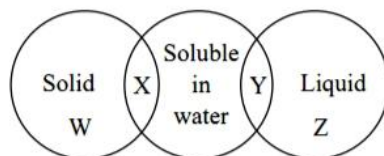
Select the correct option for L, M and N.

L	M	N
A. Extinct volcanoes	Dormant volcanoes	Active volcanoes
B. Active volcanoes	Dormant volcanoes	Extinct volcanoes
C. Dormant volcanoes	Active volcanoes	Extinct volcanoes
D. Extinct volcanoes	Active volcanoes	Dormant volcanoes

17. X is the third layer of our atmosphere from the Earth's surface. X prevents meteorites from reaching the Earth's surface by burning them. Identify X.

- A. Troposphere B. Stratosphere
 C. Mesosphere D. Exosphere

18. Refer to the given Venn diagram and select the correct option regarding W, X, Y and Z.



- A. X can be sugar, while Y can be salt.
 B. W can be sand, while Y can be honey.
 C. Y can be kerosene, while Z can be milk.
 D. X can be sand, while Z can be glycerine.

19. Force X opposes the motion of an object when the object is in contact with another object or surface. Identify force X and select the incorrect statement regarding it.

- A. On smooth surfaces, force X will be greater.
- B. Force X can be reduced by using lubricant.
- C. Force X can produce heat.
- D. If the effect of force X is more, than a ball will move to a lesser distance.

20. Match column I with column II and select the correct option.

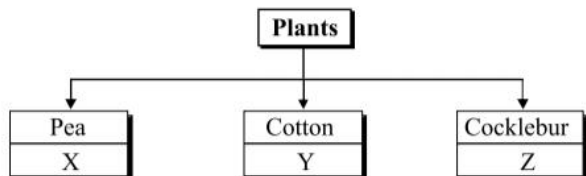
Column I	Column II
(a) Tadpole	(i) Skin
(b) Earthworm	(ii) Gills
(c) Dolphin	(iii) Trachea
(d) Mosquito	(iv) Blowholes
A. (a) – (i), (b) – (ii), (c) – (iii), (d) – (iv)	
B. (a) – (ii), (b) – (i), (c) – (iv), (d) – (iii)	
C. (a) – (iv), (b) – (iii), (c) – (ii), (d) – (i)	
D. (a) – (iii), (b) – (iv), (c) – (i), (d) – (ii)	

21. Identify the parts labelled as P, Q, R and S in the figure and select the correct option.



	P	Q	R	S
A.	Cerebrum	Medulla	Skull	Cerebellum
B.	Skull	Cerebrum	Cerebellum	Medulla
C.	Medulla	Cerebellum	Cerebrum	Skull
D.	Cerebellum	Skull	Medulla	Cerebrum

22. Some plants have been grouped as X, Y and Z in the given classification table on the basis of mechanism of seed dispersal. Select the incorrect statement regarding this.



- A. Seeds of plant X are dispersed by explosion.
- B. Seeds of plant Y are dispersed by air.
- C. Seeds of plant Z are dispersed by animals.
- D. Seeds of plants Y and Z are dispersed by water.

23. Which one of the following pairs is incorrectly matched?

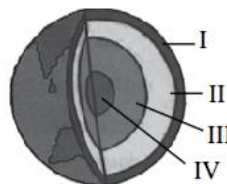
- A. Top soil – Contains most plants
- B. Subsoil – Contains partly weathered rocks
- C. Bedrock – Rich in mineral nutrients
- D. Top soil – Rich in organic matter

24. Select the correct statement regarding a volcano.



- A. A volcano is formed when hot molten rock rushes out of Earth's surface through a vertical tunnel called vent.
- B. The hollow top of the volcano that is shaped like a bowl is called a crater.
- C. When lava cools, it solidifies and forms igneous rocks.
- D. All of these.

25. The figure represents internal structure of Earth, showing its different layers i.e., I, II, III and IV. Which of the following statements are correct regarding this?

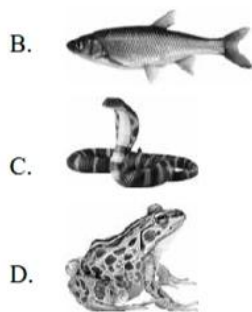


- (a) Thickness of layer I varies from 5-7 km under the ocean floor to 10-70 km under the continents.
- (b) Layer II is about 2900 km thick. It is composed of iron, magnesium, aluminium, etc.
- (c) Layer III is about 2200 km thick. It contains iron and nickel in molten state.
- (d) Layer IV is about 1200 km thick and consists primarily of iron and nickel.
- A. (a) and (b)
- B. (c) and (d)
- C. (a), (b) and (c)
- D. (a), (b), (c) and (d)

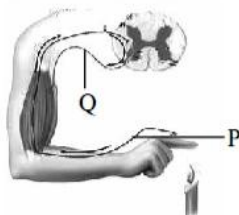
26. Which of the following animals does not possess scales?



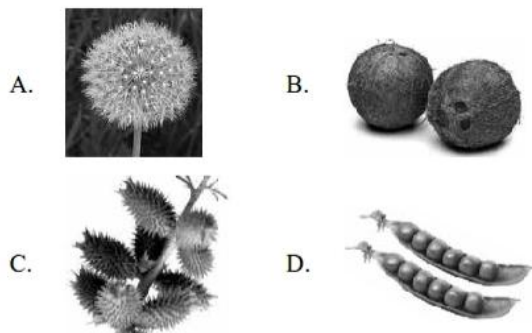
- A.



27. If you accidentally touch a very hot object, you pull back your hand immediately. Given figure represents this kind of reflex action. Identify the correct statements regarding P and Q in this figure.



- A. P can be sensory neuron which transmits message to the brain that the object is hot.
- B. P can be sensory neuron which transmits message to the spinal cord that the object is hot.
- C. Q can be motor neuron which carries message from the spinal cord to the muscles or glands.
- D. Both B and C
28. Ripe fruits of some plants burst open to scatter their seeds in all directions. This mechanism of seed dispersal is found in _____.

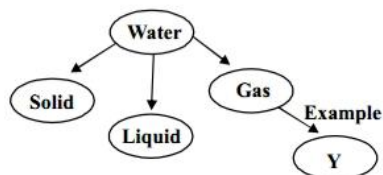


29. 'X' is a very hard igneous rock formed by slow cooling of lava. It is used for making statues. X is
- A. Basalt
- B. Granite
- C. Pumice
- D. Marble.

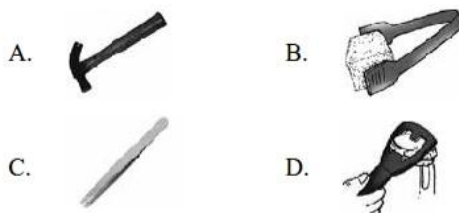
30. Which of the following activities will help in reducing pollution?
- A. Using catalytic converters in vehicles.
- B. Restricting the use of polythene bags.
- C. Spraying pesticides in the fields.
- D. Both A and B

31. Which of the following statements are correct?
1. Corona is the outermost layer of the Sun.
 2. A lunar eclipse occurs when the Moon comes in between the Sun and the Earth.
 3. Iron and magnesium are found in the inner core of the Earth.
 4. Uranus appears to be blue in colour due to the presence of methane gas in its atmosphere.
- A. 1 and 2 only
- B. 1 and 3 only
- C. 2 and 4 only
- D. 1 and 4 only

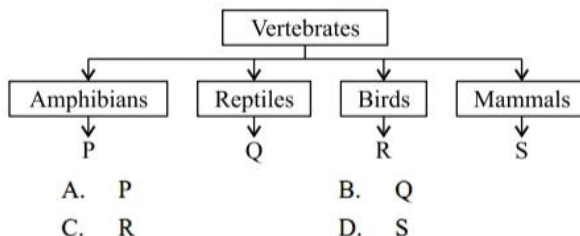
32. Which one of the following represents Y in the given flow chart ?



- A. Ice
- B. Snow
- C. Steam
- D. Hailstone
33. In which of these levers, the fulcrum is in between the load and the effort ?

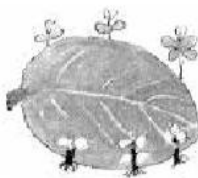


34. Study the classification chart carefully. Where should the tortoises and turtles be placed?



35. Given figure represents the production of new plants from

- A. Rose
B. *Bryophyllum*
C. Potato
D. *Xanthium*.



36. Study the given relationship regarding cropping seasons.

Rice : Radish

Select the option which correctly identifies the same relationship.

- A. Cabbage : Cauliflower
B. Bajra : Maize
C. Pea : Bean
D. Maize : Cabbage

37. The given figures X and Y show soil erosion caused by different agents. Select the correct causal agents of soil erosion shown in figures X and Y.



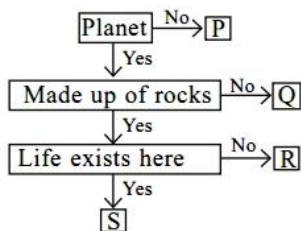
X



Y

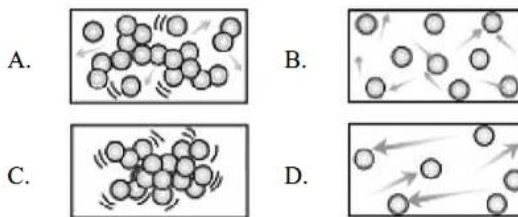
- | X | Y |
|-------------------|----------------|
| A. Human activity | Water |
| B. Water | Wind |
| C. Wind | Human activity |
| D. Wind | Water |

38. Refer to the given flow chart carefully and select the option which correctly identifies



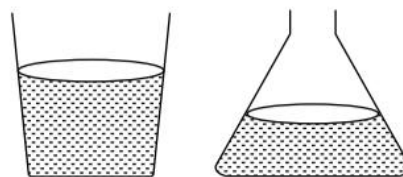
- | P | Q | R | S |
|----------|---------|---------|---------|
| A. Sun | Jupiter | Mercury | Mars |
| B. Moon | Saturn | Venus | Earth |
| C. Stars | Uranus | Earth | Venus |
| D. Moon | Neptune | Mars | Mercury |

39. The given figures show particles of the same matter. Which of them shows that the matter is coolest?



40. The given figure shows two containers X and Y of different shapes. Farheen filled container X with 100 ml of water. She then poured all the water from container X to container Y.

Which of the following changes will she observe when water is poured from container X to Y?



Container X

Container Y

- Change in shape of water.
 - Increase in mass of water.
 - Change in level of water.
 - Increase in volume of water.
- A. 1 only
B. 2 only
C. 2 and 4
D. 1 and 3

41. Which kind of energy conversion is being shown in the given figures?



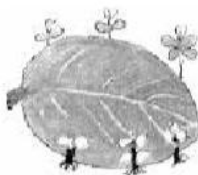
- A. Wind energy → Kinetic energy
B. Kinetic energy → Wind energy
C. Potential energy → Kinetic energy
D. Solar energy → Electrical energy

42. Which of the following statements is correct for "hitting a ball with bat"?

- A. Force is not applied but work is done.
B. Force is applied and work is done.
C. Force is applied but work is not done.
D. Neither force is applied nor work is done.

35. Given figure represents the production of new plants from

- A. Rose
B. *Bryophyllum*
C. Potato
D. *Xanthium*.



36. Study the given relationship regarding cropping seasons.

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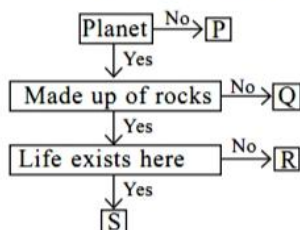
X



Y

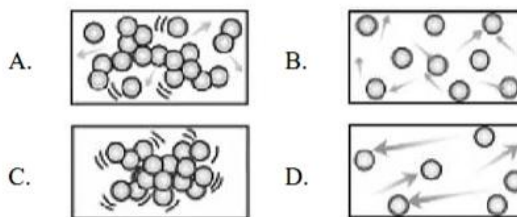
- | X | Y |
|-------------------|----------------|
| A. Human activity | Water |
| B. Water | Wind |
| C. Wind | Human activity |
| D. Wind | Water |

38. Refer to the given flow chart carefully and select the option which correctly identifies



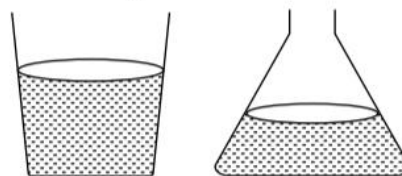
- | P | Q | R | S |
|----------|---------|---------|---------|
| A. Sun | Jupiter | Mercury | Mars |
| B. Moon | Saturn | Venus | Earth |
| C. Stars | Uranus | Earth | Venus |
| D. Moon | Neptune | Mars | Mercury |

39. The given figures show particles of the same matter. Which of them shows that the matter is coolest?



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Container Y

- Change in shape of water.
 - Increase in mass of water.
 - Change in level of water.
 - Increase in volume of water.
- A. 1 only
B. 2 only
C. 2 and 4
D. 1 and 3

41. Which kind of energy conversion is being shown in the given figures?



- A. Wind energy → Kinetic energy
B. Kinetic energy → Wind energy
C. Potential energy → Kinetic energy
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42. Which of the following statements is correct for "hitting a ball with bat"?

- A. Force is not applied but work is done.
B. Force is applied and work is done.
C. Force is applied but work is not done.
D. Neither force is applied nor work is done.

43. Which process of water purification involves addition of alum particles to separate dirt particles?

A. Chlorination
B. Filtration
C. Distillation
D. Sedimentation

44. Storms are called by different names in different places. In India it is called X; in Japan it is called Y while in Southern USA it is called Z.

What are X, Y and Z?

	X	Y	Z
A.	Tsunami	Cyclone	Typhoon
B.	Typhoon	Hurricane	Tsunami
C.	Typhoon	Cyclone	Hurricane
D.	Cyclone	Typhoon	Hurricane

45. Which layer of atmosphere protects us from the harmful ultraviolet rays of the Sun?

A. Troposphere
B. Mesosphere
C. Stratosphere
D. Both A and C

ACHIEVERS SECTION

46. The given diagram shows a cross-section of a condenser, used in the process of distillation of water.

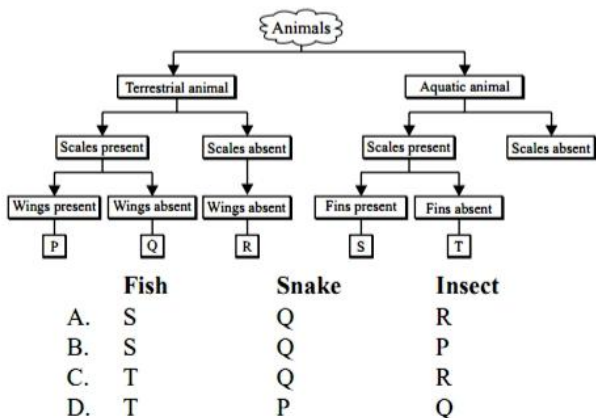
Which of the following shows the correct labels?



	L	M	N	O
A.	Hot vapour in	Cold water in	Cold water out	Condensed liquid out
B.	Hot vapour in	Cold water out	Cold water in	Condensed liquid out
C.	Condensed vapour out	Cold water in	Cold water out	Hot water in
D.	Condensed vapour out	Cold water out	Cold water in	Hot vapour in

47. Study the given flowchart.

In which group would you place a fish, a snake and an insect?



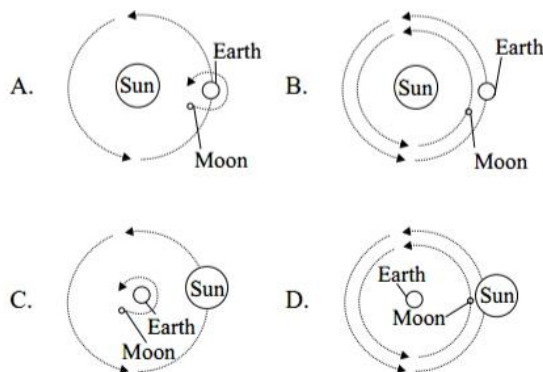
48. Select the group of plants that yield oil.

A. Sunflower, mustard, sugarcane
B. Sunflower, mustard, soyabean
C. Cotton, jute, hemp
D. Cotton, sunflower, jute

49. X is a fossil fuel used in blast furnaces, steam engines and for cooking food. Y is the chief producer of X in the world and in India X is majorly produced in Z. Select the correct option regarding X, Y and Z.

	X	Y	Z
A.	LPG	India	Bokaro
B.	Petroleum	USA	Assam
C.	Coal	China	Bokaro
D.	Coal	USA	Kerala

50. Which of these models best shows the relationship between Earth, Sun, and Moon?



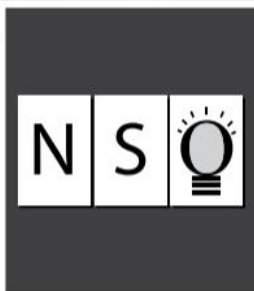
SPACE FOR ROUGH WORK

Darken your choice with HB Pencil

1.	(A) (B) (C) (D)	14.	(A) (B) (C) (D)	27.	(A) (B) (C) (D)	40.	(A) (B) (C) (D)
2.	(A) (B) (C) (D)	15.	(A) (B) (C) (D)	28.	(A) (B) (C) (D)	41.	(A) (B) (C) (D)
3.	(A) (B) (C) (D)	16.	(A) (B) (C) (D)	29.	(A) (B) (C) (D)	42.	(A) (B) (C) (D)
4.	(A) (B) (C) (D)	17.	(A) (B) (C) (D)	30.	(A) (B) (C) (D)	43.	(A) (B) (C) (D)
5.	(A) (B) (C) (D)	18.	(A) (B) (C) (D)	31.	(A) (B) (C) (D)	44.	(A) (B) (C) (D)
6.	(A) (B) (C) (D)	19.	(A) (B) (C) (D)	32.	(A) (B) (C) (D)	45.	(A) (B) (C) (D)
7.	(A) (B) (C) (D)	20.	(A) (B) (C) (D)	33.	(A) (B) (C) (D)	46.	(A) (B) (C) (D)
8.	(A) (B) (C) (D)	21.	(A) (B) (C) (D)	34.	(A) (B) (C) (D)	47.	(A) (B) (C) (D)
9.	(A) (B) (C) (D)	22.	(A) (B) (C) (D)	35.	(A) (B) (C) (D)	48.	(A) (B) (C) (D)
10.	(A) (B) (C) (D)	23.	(A) (B) (C) (D)	36.	(A) (B) (C) (D)	49.	(A) (B) (C) (D)
11.	(A) (B) (C) (D)	24.	(A) (B) (C) (D)	37.	(A) (B) (C) (D)	50.	(A) (B) (C) (D)
12.	(A) (B) (C) (D)	25.	(A) (B) (C) (D)	38.	(A) (B) (C) (D)		
13.	(A) (B) (C) (D)	26.	(A) (B) (C) (D)	39.	(A) (B) (C) (D)		

1. D 2. C 3. B 4. B 5. B 6. A 7. D 8. B 9. C 10. B 11. C 12. B 13. B 14. D 15. A 16. C 17. D 18. B 19. A 20. B 21. B 22. D 23. C 24. D 25. D 26. D 27. D 28. D 29. B 30. D 31. D 32. C 33. A 34. B 35. A 36. D 37. B 38. B 39. C 40. D 41. A 42. B 43. D 44. D 45. C 46. B 47. B 48. B 49. C 50. A

ANSWER KEY



NSO NATIONAL SCIENCE OLYMPIAD 2019 and 2020

Animals

1. Read the given characteristics regarding animal X.

- (i) It lays eggs.
- (ii) It has outer body covering of scales.
- (iii) It breathes through gills.
- (iv) It lives in aquatic habitat.

Animal X could be

- (A) Tortoise (B) Frog
- (C) Dolphin (D) Salmon. (2019)

2. Refer to the given relationship based on body coverings.

Crocodile : Blue whale : Porcupine

Select the option which satisfies the same relationship.

- (A) Snake : Arctic fox : Heron
- (B) Armadillo : Dolphin : Hedgehog
- (C) Frog : Seal : Rhinoceros
- (D) Emu : Seahorse : Spiny anteater (2019)

3. Which of the following statements is/are correct?

- (i) By migrating, Arctic tern sees two summers each year.
- (ii) For breeding, Salmon migrates from sea to fresh water whereas eel migrates from fresh water to sea.
- (iii) Humpback whales migrate from Antarctica to tropical waters of Australia for breeding.

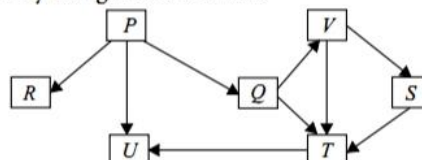
- (A) (i) and (ii) only (B) (ii) and (iii) only
- (C) (i) and (iii) only (D) (i), (ii) and (iii) (2019)

4. Which of the following events will result in an increased population of butterflies?

- (i) Reduction in the population of lizards
- (ii) Increase in the supply of plant fertilisers
- (iii) Increase in the number of flowering plants
- (iv) Increased use of insecticides by man in gardens and green belts

- (A) (i), (ii) and (iii) only
- (B) (iv) only
- (C) (i) and (iv) only
- (D) (ii) and (iv) only (2019)

5. Study the given food web.



If somehow, the population of organism V is removed from this food web, then population of organism (i) will be affected positively and that of organism (ii) will be affected negatively.

- | (i) | (ii) | |
|-------|------|--------|
| (A) P | Q | |
| (B) Q | S | |
| (C) S | T | |
| (D) U | R | (2019) |

6. On the basis of habitat, monkey belongs to (i) group of animals whereas Arctic tern belongs to (ii) group of animals.

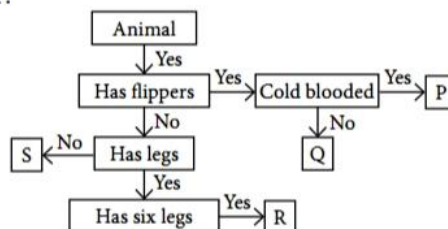
- | (i) | (ii) | |
|--------------|----------|-----------------|
| (A) Aquatic | Aerial | |
| (B) Aerial | Arboreal | |
| (C) Aquatic | Arboreal | |
| (D) Arboreal | Aerial | (2019, Level-2) |

7. Refer to the given relationship based on body coverings and select the option which satisfies the same relationship.

Arctic fox : Salmon : Parakeet

- (A) Penguin : Shark : Kingfisher
- (B) Tuna : Reindeer : Arctic tern
- (C) Mink : Sardine : Penguin
- (D) Yak : Bat : Frog (2020)

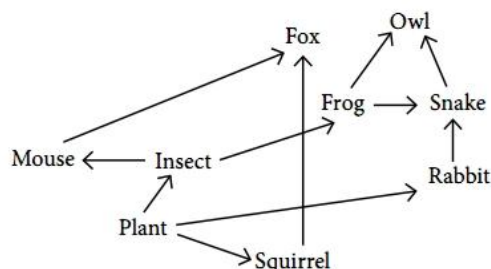
8. Study the given flow chart and identify P, Q, R, S and T.



P	Q	R	S
(A) Fish	Parrot	Cockroach	Lizard
(B) Tortoise	Polar bear	Spider	Earthworm
(C) Ostrich	Crocodile	Leopard	Kangaroo
(D) Sea turtle	Penguin	Grasshopper	Snake

(2020)

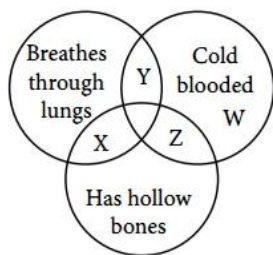
9. Refer to the given food web and select the correct statement.



- (A) If the population of owl decreases, then the population of plant will also decrease.
 (B) If the population of frog increases then the population of squirrel will also increase.
 (C) There are four herbivores in this food web.
 (D) There is only one top carnivore in this food web.

(2020)

10. Study the given Venn diagram and select the correct option.



- (A) X can be an animal that has wings and Z can be an animal that breathes through spiracles.
 (B) Y can be an animal having outer body covering of scales and X can be an animal that has outer body covering of fur.
 (C) W can be an animal that lays eggs and Y can be an animal that has hair on its body.
 (D) Y can be an animal whose young one breathes through gills and there is no animal as Z. (2020)

Human Body and Health

11. Read the given statements and correct them by replacing the italicised words with the correct option.

- (i) *Iris* is the transparent layer that covers the front of the eye.

(ii) *Inner ear* is a thin membrane like structure that vibrates on receiving sound.

(i)

(ii)

- (A) Cornea
 (B) Pupil
 (C) Lens
 (D) Pupil
- (A) Eardrum
 (B) Middle ear
 (C) Eardrum
 (D) Outer ear

(2019)

12. Which of the following should not be done if someone gets a burn?

- (A) Wash the burnt area with cold running water.
 (B) Put ice pack on it.
 (C) Apply antiseptic cream or lotion.
 (D) Prick the blisters immediately, if any are formed.

(2019)

13. Which of the following activities must be avoided in order to keep yourself safe?

- (A) Playing with sharp objects
 (B) Boarding a running bus when you are getting late for school
 (C) Running down the staircase in a hurry after the school gets over
 (D) All of these

(2019)

14. Tanmay's three friends are suffering from the following diseases.

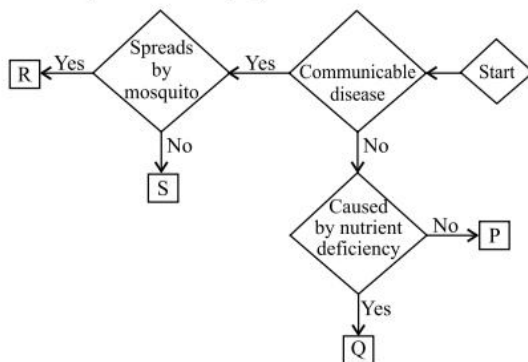
Shailja has scurvy, Samrat has measles and Suparna has chicken pox.

Who among them can communicate disease to Tanmay?

- (A) Shailja and Suparna only
 (B) Samrat and Suparna only
 (C) Samrat only
 (D) Shailja only

(2019)

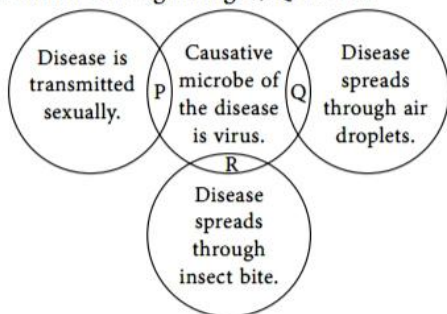
15. Refer to the given flow chart and select the option that correctly identifies P, Q, R and S.



P	Q	R	S
(A) Asthma	Goitre	Night blindness	Plague
(B) Obesity	Rickets	Anaemia	Polio
(C) Typhoid	Osteomalacia	Chikungunya	Scurvy
(D) Diabetes	Beriberi	Malaria	Common cold

(2019)

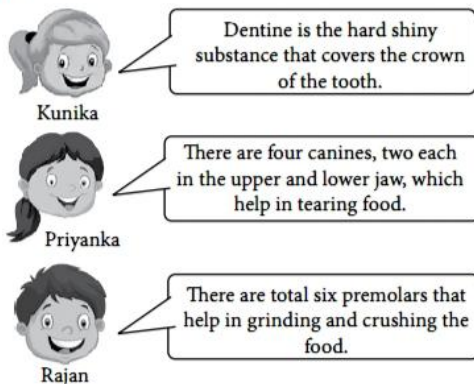
16. Refer to the given Venn diagram and select the correct statement regarding P, Q and R.



- (A) P could be an incurable disease that damages immune system of the infected person.
 (B) R could be a disease in which blood platelet count of a person goes down significantly.
 (C) Both P and Q could be communicable diseases, of which Q could get cured on its own.
 (D) All of these

(2019, Level-2)

17. Refer to the given conversation among three friends.



Which of these children made a correct statement?

- (A) Kunika only
 (B) Priyanka only
 (C) Priyanka and Rajan only
 (D) Kunika and Rajan only

(2020)

18. How many diseases given in the box spread from contaminated food and water?

Diarrhoea, Flu, Measles, Dengue, Cholera, Plague, Typhoid, Ringworm

- (A) 5 (B) 2
 (C) 3 (D) 4

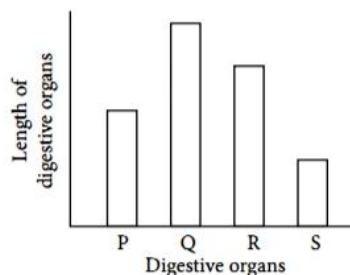
(2020)

19. Unscramble the given options to select the odd one out on the basis of types of diseases.

- (A) UNEGDE (B) EERBIIBR
 (C) OTGRIE (D) RCVUYS

(2020)

20. Study the given graph and answer the following question.



Which digestive organ is involved in passing digested food into the blood?

- (A) P (B) R
 (C) S (D) Q

(2020)

21. Refer to the given figure and select the correct statement regarding it.



- (A) It consists of 12 small bones.
 (B) Its first bone is called atlas.
 (C) It gives protection to heart.
 (D) Ball and socket joints are present between its bones.

(2020)

22. Which joints are primarily involved while performing following actions?

- (i) Bending of forearm
 (ii) Moving arm in a circle
 (iii) Turning head from side-to-side
- | (i) | (ii) | (iii) |
|---------------------------|-----------------------|-----------------------|
| (A) Ball and socket joint | Gliding joint | Hinge joint |
| (B) Pivot joint | Gliding joint | Ball and socket joint |
| (C) Gliding joint | Hinge joint | Pivot joint |
| (D) Hinge joint | Ball and socket joint | Pivot joint |

(2020)

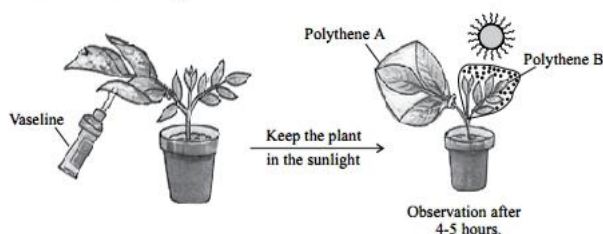
Plants

23. _____ is the plant that disperses its seeds by the same agency as the plant shown here.



- (A) Litchi (B) Coconut
(C) *Xanthium* (D) Balsam (2019)

24. Ravi took a potted plant. He applied vaseline on both sides of some leaves and wrapped them in polythene A, while he wrapped some leaves in polythene B without applying vaseline and kept the set-up in sunlight as shown in the figure.



Select the correct statement regarding it.

- (A) He applied vaseline as he wants to study transpiration in plants.
(B) He kept plant in sunlight because higher temperature favours transpiration.
(C) Water released by leaves through transpiration in polythene B turns into water droplets by condensation.
(D) All of these (2019)

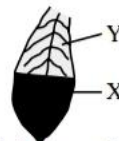
25. Refer to the given word grid.

L	K	I	M	O	N	O
I	H	A	N	B	O	K
N	O	C	Y	O	R	I
E	C	O	L	T	O	W
N	D	L	O	O	W	S
K	O	M	N	E	E	M

Which of the following is not hidden in this grid?

- (i) Leaves of this plant are used to protect clothes from insects.
(ii) The traditional dress of Korea.
(iii) Type of man-made fibre.
(iv) Fibre obtained by killing an insect.
(A) (i) only (B) (iv) only
(C) (iii) only (D) (ii) only (2019)

26. Preeti performed an iodine test on a leaf and the result is shown here.



Which of the following conclusions cannot be made from this?

- (A) Part X of the leaf had chlorophyll while part Y lacked chlorophyll.
(B) Part X of the leaf received sunlight while part Y did not receive sunlight.
(C) Part X of the leaf lacked CO_2 while part Y received CO_2 .
(D) Starch was present in part X of the leaf while in part Y it was absent. (2019)

27. Read the given paragraph with few blanks and select the option that correctly fills these blanks.

Plants reproduce vegetatively by different means. Plants like _____ reproduce with the help of leaves, _____ and _____ reproduce by stem and _____ reproduces by roots. Some plants like ferns reproduce by _____.

- (A) *Bryophyllum*, Sweet potato, Potato, Onion, Spores
(B) *Begonia*, Garlic, Strawberry, Ginger, Seeds
(C) *Begonia*, Onion, Potato, Sugarcane, Seeds
(D) *Bryophyllum*, Ginger, Rose, *Dahlia*, Spores (2019)

28. Aarohi grouped plants on the basis of their mode of seed dispersal. By mistake, she put one wrong member in each group. Identify the odd member and select the correct option regarding this.

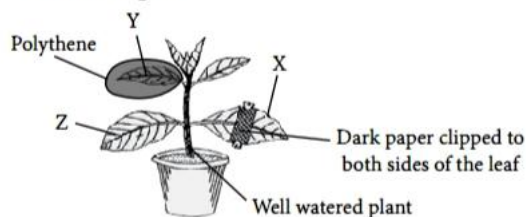
Group I : Maple, Lotus, *Dandelion*

Group II : Blackberry, Litchi, Coconut

Group III : Cocklebur, *Geranium*, Pea

- (A) Lotus is incorrectly placed in group I and should be replaced with *Euphorbia*.
(B) Litchi in group II should be interchanged with *Geranium* in group III.
(C) Blackberry is incorrectly placed in group II and should be replaced with cotton.
(D) Cocklebur is incorrectly placed in group III and should be replaced with balsam. (2019, Level-2)

29. A potted plant was kept in a dark room for 2-3 days. Then this potted plant was used for an experimental set-up and was kept in the sunlight for a few days as shown in the figure.

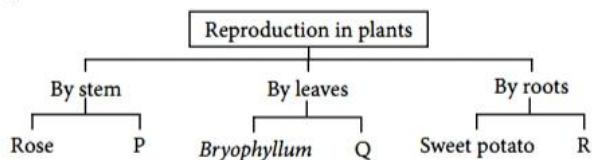


Which of the following statements are correct regarding this experiment?

- (i) Iodine solution will turn blue-black when put on the covered part of leaf X.
 - (ii) Iodine solution will remain as such when put on leaf Z.
 - (iii) Iodine solution will remain as such when put on the part of leaf X covered with dark paper.
 - (iv) Polythene around leaf Y will show water droplets.
- (A) (i) and (iii) only
 (B) (ii), (iii) and (iv) only
 (C) (iii) and (iv) only
 (D) (i) and (ii) only

(2020)

30. Study the given classification table and identify P, Q and R.



- | P | Q | R |
|---------------|---------------|---------|
| (A) Banana | Begonia | Dahlia |
| (B) Sugarcane | Dahlia | Begonia |
| (C) Radish | Strawberry | Garlic |
| (D) Onion | Water lettuce | Ginger |

(2020)

31. Match column I with column II and select the correct option from the given codes.

- | Column I | Column II |
|---|--------------------|
| P. Plant in which leaf is modified into spine | (i) Duckweed |
| Q. Plant that has spongy body filled with air | (ii) Lettuce |
| R. Plant in which leaves trap insects | (iii) Cactus |
| S. Plant with edible leaf | (iv) Pitcher plant |

- | P | Q | R | S |
|-----------|-------|------|-------|
| (A) (i) | (iii) | (ii) | (iv) |
| (B) (ii) | (iii) | (iv) | (i) |
| (C) (iv) | (ii) | (i) | (iii) |
| (D) (iii) | (i) | (iv) | (ii) |

(2020)

32. Radhika was asked to list down some rabi crops. By mistake, she included some kharif crops also in her list as shown in the given box.

Wheat, Maize, Rice, Gram, Mustard, Barley, Jowar

Select the rabi crops from the given list.

- (A) Wheat, Maize, Jowar
- (B) Gram, Jowar, Mustard
- (C) Rice, Gram, Barley
- (D) Wheat, Gram, Mustard, Barley

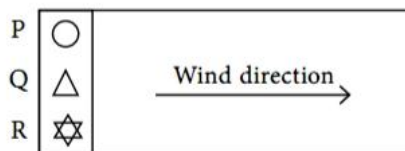
(2020)

33. Select the correct match.

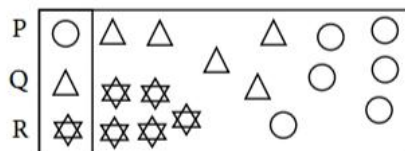
- | Seed/Fruit | Mode of dispersal |
|---|-------------------|
| (A)  | - Explosion |
| (B)  | - Wind |
| (C)  | - Animal |
| (D)  | - Water |

(2020)

34. Swati planted plants P, Q and R in her field as shown in picture 1. She left the field untouched for one month. After one month, what she saw is shown in picture 2.



Picture 1



Picture 2

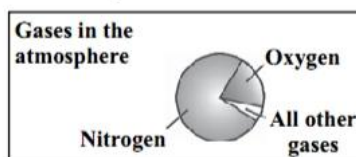
Which of these plants is likely to have its seeds dispersed by an animal?

- (A) P
- (B) Q
- (C) R
- (D) Both P and R

(2020)

Natural Resources and Indian Heritage

35. Which of these is the most accurate description of air, based on the pie-chart?



- (A) Two-third nitrogen, two-third oxygen and one-tenth other gases
 (B) Three-quarter oxygen and one-third nitrogen and other gases
 (C) One-half nitrogen and one-half oxygen and other gases
 (D) One-fifth oxygen and four-fifth nitrogen and other gases (2019)

36. Read the given statements regarding types of rock.

- (i) P is used by dentists for polishing teeth.
 (ii) Q is rich in mineral calcium carbonate and is used for making cement.

(iii) R is used for making statues and floorings.

Select the option which correctly identifies the category of rocks to which P, Q and R belongs.

- | P | Q | R |
|----------------------|------------------|------------------|
| (A) Metamorphic rock | Igneous rock | Sedimentary rock |
| (B) Igneous rock | Metamorphic rock | Sedimentary rock |
| (C) Igneous rock | Sedimentary rock | Metamorphic rock |
| (D) Sedimentary rock | Metamorphic rock | Igneous rock |
- (2019)

37. Refer to the given figure and select the correct option regarding it.



- (A) It is situated on the bank of river Yamuna and was built by emperor Shah Jahan.
 (B) It is situated in Mehrauli (New Delhi) and has five storeys and 379 steps.
 (C) It was built by Maharaja Sawai Jai Singh and was used to forecast weather changes.
 (D) It was built to commemorate the visit of King George V and Queen Mary in 1911. (2019)

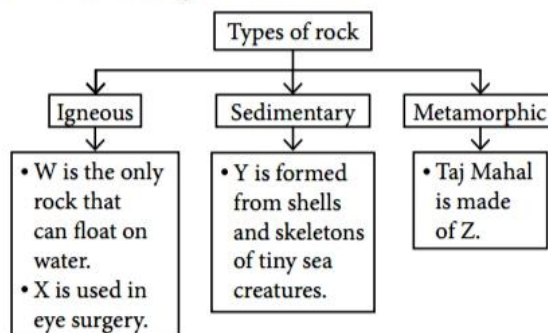
38. Which of the following statements is correct about water cycle?

- (A) It is the mechanism of transferring water from the sea to the land.
 (B) It carries in, from the sea, the mineral salts that plants need for their growth.
 (C) It ensures that living things are provided with water for their survival.
 (D) Both (A) and (C) (2019)

39. At a certain time of the day, the temperature over land is 21°C while the temperature over sea is 36°C . At this time _____.

- (A) The air pressure is lower over land than that over sea
 (B) Breeze will flow from land towards the sea
 (C) Breeze will flow from sea towards the land
 (D) None of these (2019)

40. Refer to the given flow chart.



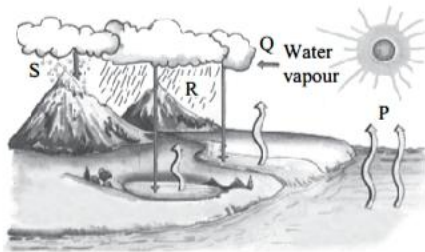
Identify W, X, Y and Z and select the correct statement regarding them.

- (A) Red Fort is made of W.
 (B) X typically breaks into flat thin layers and is used in making cement.
 (C) Y is porous and light weight rock.
 (D) Z is formed from a type of sedimentary rock and found in different colours. (2019)

41. Which of the following statements is correct?

- (A) Quartzite is formed from sandstone.
 (B) Marble is formed of clay particles that have been hardened together under high pressure.
 (C) Gneiss is formed from basalt.
 (D) Obsidian is formed due to slow cooling down of lava. (2019, Level-2)

42. Refer to the given figure representing water cycle and its different processes labelled as P, Q, R and S.



Which of the following statements is correct regarding it?

- (A) Process P is responsible for the formation of dew on humid cold nights.
- (B) Process Q does not involve any change in state of water.
- (C) Excess of process R can sometimes lead to drought.
- (D) Process S is a form of precipitation that takes place at very low temperatures. (2020)

43. Select the correct statement regarding natural resources.

- (A) They can never be exhausted.
- (B) They are obtained from soil only.
- (C) Wind energy is a renewable natural resource.
- (D) Coal is not a natural resource. (2020)

44. Take a glass and insert it without tilting into a tub containing water. What will you observe?



- (A) Level of water in the tub will go down.
- (B) Water will enter into the glass.
- (C) Water will not enter into the glass.
- (D) Air bubbles will be observed in water. (2020)

45. Read the given statements and correct them by replacing the italicised words with the correct option.

- (i) *Conglomerate* is an igneous rock that forms when magma slowly cools down beneath the earth's surface.
- (ii) *Slate* is a sedimentary rock that is formed of clay particles that have been hardened together under high pressure.

(i)

(ii)

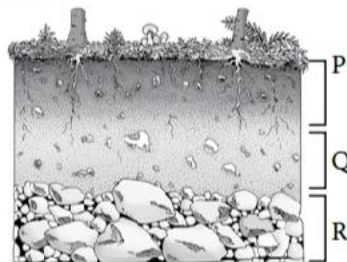
- (A) Quartzite
- (B) Gneiss
- (C) Limestone
- (D) Granite
- (A) Pumice
- (B) Marble
- (C) Pumice
- (D) Shale

(2020)

46. Konark Sun temple is located in _____.

- (A) Odisha
- (B) Kerala
- (C) Rajasthan
- (D) Jammu and Kashmir (2020)

47. Study the given figure of soil profile and select the correct statement.



- (A) Layer Q has water and very less amount of organic matter.
- (B) Plants obtain nutrients from layer R.
- (C) Layer P is the most infertile layer of the soil.
- (D) Roots of plants always grow till layer R. (2020)

48. Which of the following statements is incorrect?

- (A) Quartz, mica, silica and sand are some examples of non-metallic minerals.
- (B) Iron is a metallic mineral obtained from its ore called hematite.
- (C) Coal and crude oil are energy minerals.
- (D) Diesel, petrol, kerosene, wax and lubricants are derived from coal. (2020)

Pollution and Calamities

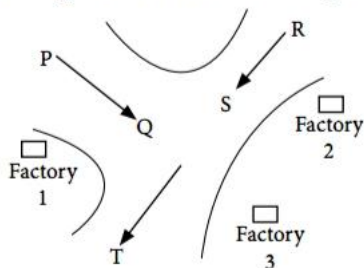
49. Which one of the following pairs is correctly matched?

Problem	Solution
(A) Air pollution	Avoiding catalytic converters in automobiles
(B) Water pollution	Discharging industrial waste into nearby water
(C) Land pollution	Recycling paper and reusing plastic bottles whenever possible
(D) Air pollution	Using more diesel/petrol over CNG (2019)

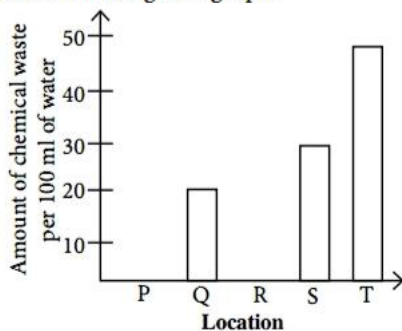
50. Which of the following statements is incorrect?

- (A) The hollow top of the volcano is called crater.
- (B) The liquid that comes out of a volcano and reaches the Earth's surface is called magma.
- (C) Based on the frequency of eruptions, volcanoes can be active, dormant or extinct.
- (D) Mauna Kea in Hawaii Islands is an example of dormant volcano. (2019)

51. Soil pollution can be reduced by
 (A) Using paper bags to carry different items
 (B) Using fertilisers to increase plant yield
 (C) Throwing old plastic toys in garbage
 (D) Throwing plastic bottles in garbage. (2019)
52. The given figure shows a river flowing downstream.



Water samples were collected from five different locations of the river viz P, Q, R, S and T to determine the amount of chemical waste present in them. The results obtained were recorded in the given graph.



Based on the above given information, select the correct statements.

- (i) Factory 2 discharged more chemical waste into the river than factory 1.
 (ii) Water at locations P and R is more fit for domestic use than water at location T.
 (iii) Location T is most suitable for fish culture.
 (A) (i) and (iii) only
 (B) (ii) and (iii) only
 (C) (i) and (ii) only
 (D) (i), (ii) and (iii) (2019)

53. Select the correct statements.

- (i) Tremors that follow massive earthquakes are called aftershocks.
 (ii) Mt. Etna is a dormant volcano.
 (iii) Earthquake is measured on the Vernier scale.
 (iv) Breaking of dam can cause floods.
 (A) (i) and (ii) only (B) (i) and (iv) only
 (C) (ii) and (iv) only (D) (ii) and (iii) only

(2019, Level-2)

54. The rapid flow of snow down a hill or mountain side is called _____.

- (A) Tsunami (B) Avalanche
 (C) Snowfall (D) Typhoon (2020)

55. Select the correct option to fill in the blanks in the following paragraph.

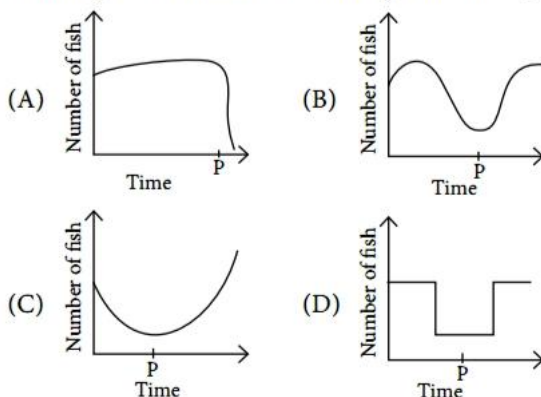
(i) is stored in the interior of the Earth in sort of a large reservoir called (i) chamber. When the pressure in the (i) chamber builds up, the (i) escapes out through a (ii). The (iii) cools down and solidifies to form a volcanic mountain that takes thousand of years to form. The hollow top of the volcanic mountain is a bowl-shaped structure called (iv).

- | (i) | (ii) | (iii) | (iv) |
|-----------|--------|-------|--------|
| (A) Lava | Vent | Magma | Crater |
| (B) Magma | Vent | Lava | Crater |
| (C) Magma | Crater | Lava | Vent |
| (D) Lava | Crater | Magma | Vent |
- (2020)

56. Which of the following can lead to flood, tsunami and landslide?

- (A) Forest fire (B) Drought
 (C) Earthquake (D) Famine (2020)

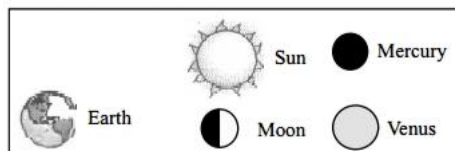
57. Which of the following graphs shows the effect of large amount of oil spill in the water body on the life of fish? (P → Time at which oil spill occurred)

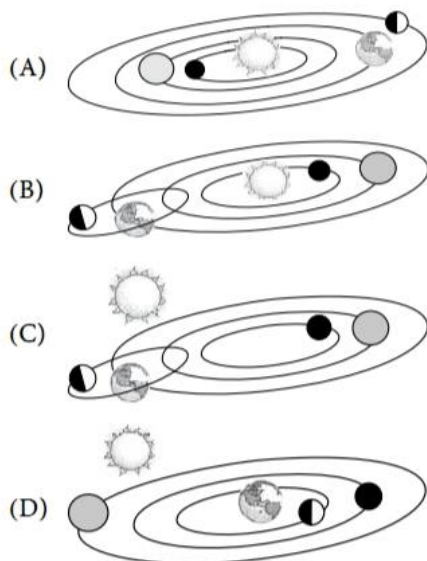


(2020)

Earth and Universe

58. Which of the following figures shows the correct positions of the given celestial bodies in the solar system?





59. The given diagrams show the shapes of the Moon on different nights.



Which one of the following diagrams shows the correct shape of the Moon on 28th Sept?



60. Which of the following statements are correct?

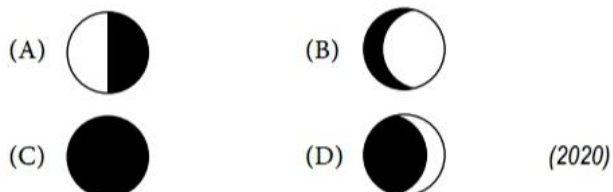
- (i) There is no water or air on the Moon.
 - (ii) The temperature on the Moon during day time is 50°C .
 - (iii) The gravitational pull of the Moon is about one-third of that of the Earth.
 - (iv) Moon completes one revolution in about 28 days.
- (A) (i) and (ii) only (B) (ii) and (iii) only
(C) (i) and (iv) only (D) (i) and (iii) only (2019)

61. Select the correct statement.

- (A) Uranus is the second largest planet in the solar system.
 - (B) Neptune takes about 165 Earth years to orbit around the Sun.
 - (C) The distinguishing feature of Venus is the 'Great Red Spot' on its surface.
 - (D) Mercury is the hottest planet in the solar system.
- (2019, Level-2)

62. Soumya observes  on 8th May at night.

Which of the following phases of Moon will she most likely observe on 22nd May?



63. What is the Hindi name of the coldest planet of our solar system?

- (A) *Mangal* (B) *Shani*
(C) *Varun* (D) *Arun* (2020)

64. One night, Navika watched a constellation in the sky over a period of several hours. She found that the constellation seemed to move across the sky. Which of these can explain this?

- (A) Some constellations are moving constellations.
 - (B) As the Earth rotates, constellations seem to move.
 - (C) The outer portions of the galaxy rotates very slowly around the Earth.
 - (D) All constellations move randomly through the sky.
- (2020)

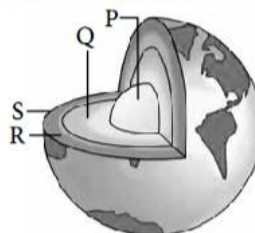
65. Read the following statements and select the option that correctly identifies them as true (T) and false (F) ones.

- (i) Moon does not have gravity.
- (ii) Apollo 11 was the first manned spacecraft to land on the Moon, on 20th July 1969.
- (iii) Uranus is blue in colour due to the presence of helium gas in its atmosphere.
- (iv) Mercury takes about 88 days to complete one revolution around the Sun.

(i)	(ii)	(iii)	(iv)
(A) F	F	T	T
(B) T	T	T	F
(C) T	F	T	F
(D) F	T	F	T

(2020)

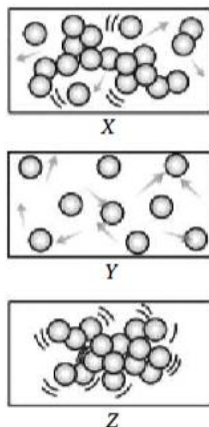
66. Refer to the given figure of internal structure of Earth and select the correct statement.



- (A) R is denser than Q.
 (B) The upper part of R is made up of solid rocks and lower part consists of molten rocks.
 (C) P remains in liquid state as it is under extreme temperature and pressure.
 (D) S is the thickest layer of the Earth. (2020)

Matter and Materials

67. In the given figures, X, Y and Z represent three different states of matter.



Select the correct option regarding X, Y and Z.

- (A) X is a liquid while Z is a gas.
 (B) Y is a solid while X is a liquid.
 (C) X and Y are solids while Z is a gas.
 (D) Y is a gas while Z is a solid. (2019)

68. Ananya mixed some salt, some soil and some metallic nails in three different beakers of water separately. Select the correct option regarding the methods of separation of these components from their mixtures.

- (A) Metallic nails can be separated by filtration.
 (B) Soil can be separated by sedimentation and decantation.
 (C) Salt can be separated by distillation.
 (D) All of these (2019)

69. Which of the following statements is incorrect?

- (A) Linen is obtained from plants and absorbs water well.
 (B) Plastic conducts electricity very well.
 (C) Evaporation is faster when the surface area is larger.
 (D) Copper vessels lose their shine over time due to action of air and moisture on them. (2019)

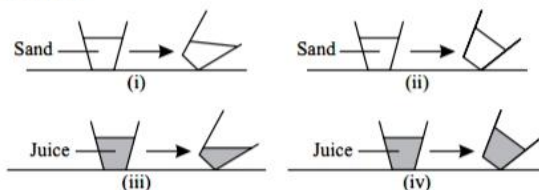
70. Three glasses X, Y and Z having equal amount of water were taken at room temperature and equal amount

of sugar was added to each one of them. After that, X was cooled, Y was heated and Z was left undisturbed. If tasted immediately, water will be sweetest in the glass



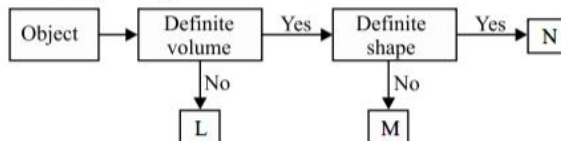
- (A) X (B) Y
 (C) Z (D) All will taste the same. (2019)

71. Which of the following diagrams correctly show what happens when a glass of juice and a glass of sand are tilted?



- (A) (ii) and (iv) only (B) (i) and (iv) only
 (C) (i) and (iii) only (D) (ii) and (iii) only (2019)

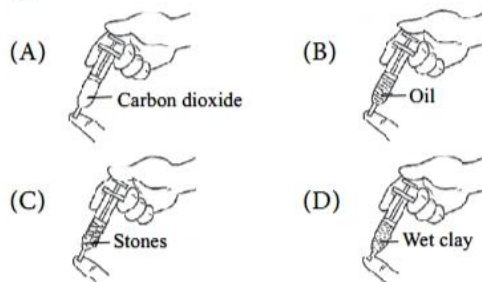
72. Study the given flow chart.



Which of the following options correctly identifies the examples that belong to L, M and N?

- | L | M | N |
|--------------|-------------|----------------|
| (A) Hydrogen | Juice | Urine |
| (B) Water | Electricity | Carbon dioxide |
| (C) Oxygen | Milk | Tumbler |
| (D) Stapler | Curd | Nitrogen |
- (2019)

73. Ravi filled four identical syringes with different substances as shown in the given figures. In which syringe will the plunger move the fastest when pushed in?



(2019, Level-2)

74. Select the option that correctly gives the examples of physical and chemical changes.

- | Physical change | Chemical change |
|----------------------|-------------------|
| (A) Tearing of paper | Breaking of glass |
| (B) Burning of paper | Cooking of food |
| (C) Rusting of iron | Melting of butter |
| (D) Formation of ice | Burning of wood |
- (2020)

75. Rohit was asked to group materials on the basis of their ability to pass light through them. By mistake, he made one wrong group. Identify the wrong group and select the correct option.

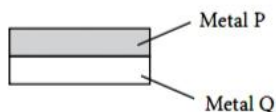
- (A) Glass, Water, Air
 (B) Mirror, Wood, Aluminium sheet
 (C) Frosted glass, Butter paper, Wooden door
 (D) Iron almirah, Tin can, Ceramic plate
- (2020)

76. Study the given table and identify materials X, Y and Z.

Characteristics	Materials		
	X	Y	Z
Conductor of electricity	×	✓	×
Bends	✓	✓	✓
Absorbs water	×	×	✓

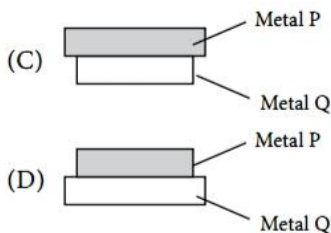
- | X | Y | Z |
|------------------|-------------|-------------|
| (A) Sponge | Rubber band | Iron sheet |
| (B) Balloon | Copper wire | Jute bag |
| (C) Copper wire | Balloon | Rubber band |
| (D) Cotton sheet | Cork | Sponge |
- (2020)

77. Metal strips P and Q are joined together to form a bimetallic strip as shown in the figure.



If metal P expands more than metal Q on heating, then which of the following options correctly shows the shape of bimetallic strip after heating?

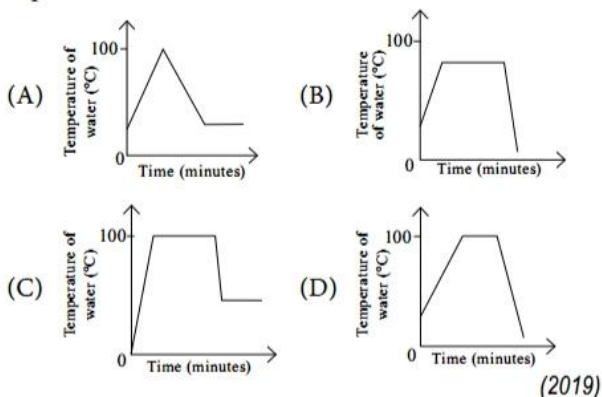
- (A)
- (B)



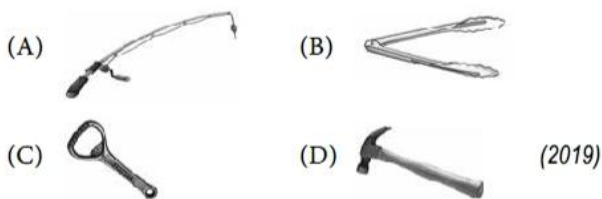
(2020)

Force and Energy

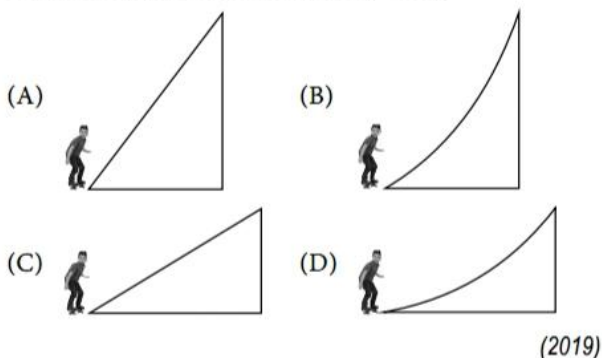
78. Anu heated some tap water in a kettle until it reached its boiling point. She boiled the water for a few minutes. She then placed the kettle of boiled water inside the refrigerator, to cool it down. Which of the following graphs correctly represents changes in the temperature of water in the kettle with time during the experiment?



79. Which of the following is a second class lever?



80. Which ramp setup will require the least amount of force for the skater to move up on it?



74. Select the option that correctly gives the examples of physical and chemical changes.

- | Physical change | Chemical change |
|----------------------|-------------------|
| (A) Tearing of paper | Breaking of glass |
| (B) Burning of paper | Cooking of food |
| (C) Rusting of iron | Melting of butter |
| (D) Formation of ice | Burning of wood |
- (2020)

75. Rohit was asked to group materials on the basis of their ability to pass light through them. By mistake, he made one wrong group. Identify the wrong group and select the correct option.

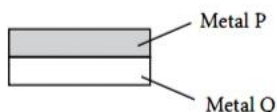
- (A) Glass, Water, Air
 (B) Mirror, Wood, Aluminium sheet
 (C) Frosted glass, Butter paper, Wooden door
 (D) Iron almirah, Tin can, Ceramic plate
- (2020)

76. Study the given table and identify materials X, Y and Z.

Characteristics	Materials		
	X	Y	Z
Conductor of electricity	×	✓	×
Bends	✓	✓	✓
Absorbs water	×	×	✓

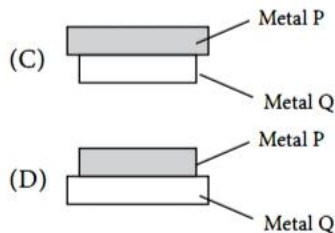
- | X | Y | Z |
|------------------|-------------|-------------|
| (A) Sponge | Rubber band | Iron sheet |
| (B) Balloon | Copper wire | Jute bag |
| (C) Copper wire | Balloon | Rubber band |
| (D) Cotton sheet | Cork | Sponge |
- (2020)

77. Metal strips P and Q are joined together to form a bimetallic strip as shown in the figure.



If metal P expands more than metal Q on heating, then which of the following options correctly shows the shape of bimetallic strip after heating?

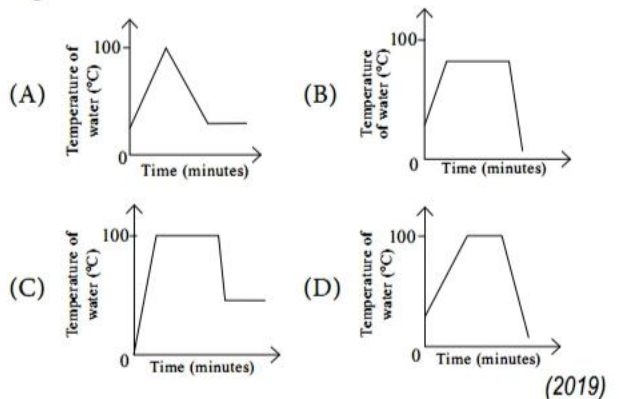
- (A)
- (B)



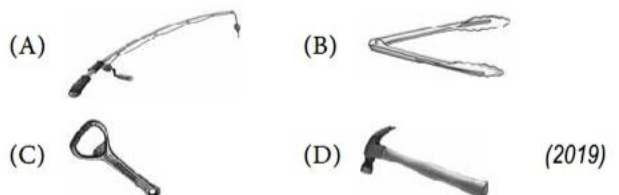
(2020)

Force and Energy

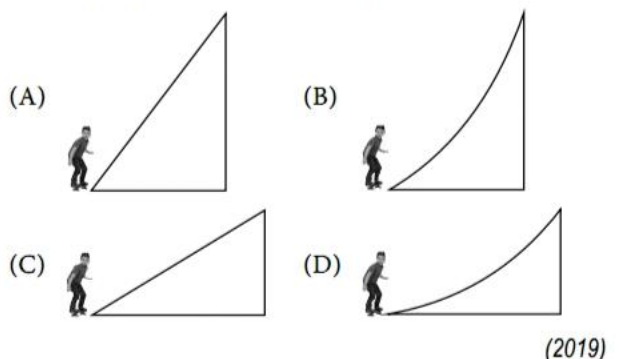
78. Anu heated some tap water in a kettle until it reached its boiling point. She boiled the water for a few minutes. She then placed the kettle of boiled water inside the refrigerator, to cool it down. Which of the following graphs correctly represents changes in the temperature of water in the kettle with time during the experiment?



79. Which of the following is a second class lever?



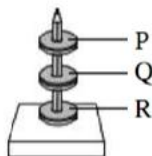
80. Which ramp setup will require the least amount of force for the skater to move up on it?



81. Which of the following is a correct match of the everyday object and the simple machine involved in its functioning?

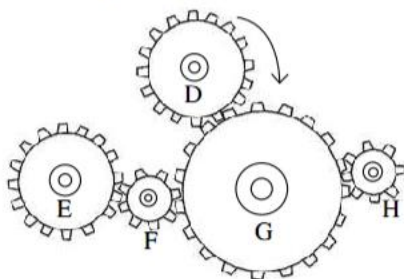
- (A) Steering of a car – Pulley
(B) Escalator – Wedge
(C) Staircase – Inclined plane
(D) Hospital ramp – Wheel and axle (2019)

82. The diagram below shows three ring magnets, P, Q and R. Identify the poles of P, Q and R.



- | P | Q | R |
|-----------|-------|-------|
| (A) North | North | North |
| (B) North | North | South |
| (C) South | North | South |
| (D) South | North | North |
- (2019)

83. Refer to the given figure.



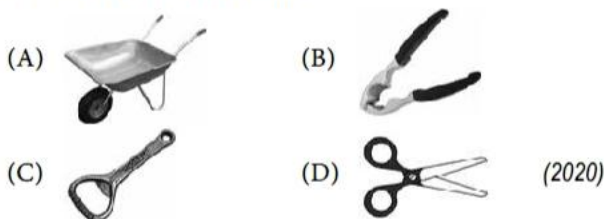
If gear D rotates in clockwise direction, select the directions in which other gears will rotate.

- (A) E - Anticlockwise, F - Clockwise,
G - Anticlockwise, H - Clockwise
(B) E - Clockwise, F - Anticlockwise,
G - Clockwise, H - Anticlockwise
(C) E - Anticlockwise, F - Anticlockwise,
G - Clockwise, H - Clockwise
(D) E - Clockwise, F - Clockwise,
G - Anticlockwise, H - Anticlockwise (2019, Level-2)

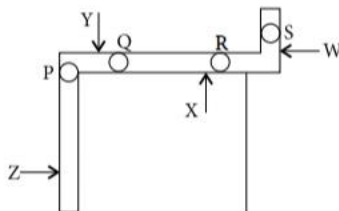
84. In which of these actions work is not said to be done?

- (A) Hammering a nail into the wall
(B) Hitting a ball with a bat
(C) Holding a bucket of water
(D) Cutting a paper (2020)

85. Select the odd one out.



86. The given diagram shows a metal tube with four similar drops of wax attached to positions P, Q, R and S on it.



Saurabh heated the metal tube at one point and recorded the time taken for the drops of wax to melt as shown in the given table.

Position of wax drops	Time taken for the wax drops to melt (seconds)
P	40
Q	36
R	22
S	26

Based on the above results, at which point (W, X, Y or Z), did Saurabh heat the metal tube?

- (A) W (B) Y
(C) X (D) Z (2020)

Mixed Bag Questions

Food and Digestion

87. Starting from the first letter strike out every alternate letter and select the option that gives the method of food preservation in which moisture is removed from the food item.

- (A) AFSRQEQEQZTILNMG P
(B) JOPITLUIVNSGO
(C) PBTAMKNIONSGU
(D) TDORAYBIENFGJ (2019)

Human Needs

88. Cross out every alternate letter, starting from the first one and select the option which gives the name of a fibre that is man-made.

- (A) ACCOKTJTBOMN (B) QWFOGODL
(C) ESIIMLPK (D) CNFYHLMONN (2020)

HINTS & EXPLANATIONS

1. (D) : According to the given characteristics, the animal X could be a fish (salmon), as it is an aquatic animal that lays eggs, has outer body covering of scales and breathes through gills. Tortoise is a reptile, it breathes through lungs; skin of frog (amphibian) is smooth and slimy and devoid of scales; dolphin is a mammal that gives birth to babies.
2. (B)
3. (D)
4. (A) : Increased use of insecticide will decrease population of butterflies whereas reduction in population of lizard, increase in supply of plant fertilisers and increased number of flowering plants will increase population of butterflies.
5. (B) : According to the given food web, V is the predator of Q and prey of S. Hence, if population of V is removed then population of Q will increase and that of S will decrease.
6. (D) : Monkey spends most of its time on trees, hence it is called an arboreal animal. Arctic tern is a bird, it spends most of its time in the air, hence it is called an aerial animal.
7. (C) : Arctic fox and mink have fur on their body. Salmon and sardine have scales on their body. Parakeet and penguin have feathers on their body.
8. (D)
9. (B) : If the population of owl decreases, then the populations of frog increases, insect decreases and that of plant will increase. There are three herbivores in the given food web - squirrel, rabbit and insect. There are two top carnivores in this food web- fox and owl.
10. (D) : In the given Venn diagram, X is bird, Y can be amphibian or reptile, W can be fish or insect and there is no such animal as Z.
11. (A)
12. (D) : In case of severe burns, the affected area becomes red and blisters may occur. One should never prick the blisters as it can cause infection and delay the healing process.
13. (D) : We should never play with sharp objects, never run after a moving bus and never run down the staircase in a hurry.
14. (B) : Measles and chicken pox are communicable diseases. Hence, Samrat and Suparna can communicate these diseases to Tanmay. Scurvy is a non-communicable disease caused due to deficiency of vitamin C. Hence, Tanmay will not get it from Shailja.
15. (D)
16. (D)
17. (B) : Dentine supports the enamel on the teeth. It lies below the enamel. There are total eight premolars.
18. (C) : Diarrhoea, cholera and typhoid spread from contaminated food and water.
19. (A) : DENGUE (A) is a communicable disease while BERIBERI, GOITRE and SCURVY are non-communicable diseases.
20. (D) : Small intestine is the longest organ of digestive system. It absorbs the digested food and passes it into the blood.
21. (B) : The given figure is of vertebral column. It consists of 33 small bones. It gives protection to the spinal cord. Shoulder and hip joints are ball and socket joints.
22. (D)
23. (D) : The plant shown in the given figure is pea plant. The seeds of pea plant get dispersed by explosion. Among the given options, seeds of litchi and *Xanthium* are dispersed by animals. Seeds of coconut are dispersed by water and seeds of balsam are dispersed by explosion.
24. (D)
25. (B) : Leaves of neem plant are used to protect clothes from insects. Traditional dress of Korea is hanbok. Nylon is a man-made fibre and silk fibres are obtained by killing an insect. Only (iv) is not hidden in the word grid.
26. (C) : According to the given figure, upon performing iodine test, X part of the leaf turns blue black whereas part Y remains as it is. Therefore, it can be inferred that part X of the leaf had starch whereas part Y did not have starch. Hence, part X must have received CO_2 and part Y must have lacked it.
27. (D) : Vegetative reproduction refers to the formation of new plants from vegetative part of a plant. *Bryophyllum*

and *Begonia* reproduce by leaves. Sweet potato and *Dahlia* reproduce vegetatively with the help of roots. Potato, onion, garlic, strawberry, sugarcane, ginger and rose reproduce by stem. Fern reproduces by formation of spores.

28. (D): In group I, seeds of maple and *Dandelion* are dispersed by wind while seeds of lotus are dispersed by water. In group II, seeds of blackberry and litchi are dispersed by animals while seeds of coconut are dispersed by water. In group III seeds of cocklebur are dispersed by animals while seeds of *Geranium* and pea are dispersed by explosion. Balsam seeds are also dispersed by explosion

29. (C): Iodine solution will turn blue-black when put on the uncovered part of leaf X and on whole leaf Z due to the presence of starch. Polythene around leaf Y shows water droplets due to transpiration.

30. (A): Rose and banana reproduce by stem. *Bryophyllum* and *Begonia* reproduce by leaves. Sweet potato and *Dahlia* reproduce by roots.

31. (D)

32. (D)

33. (C): Dandelion (A) – Wind

Lotus (B) – Water

Cocklebur (C) – Animal

Poppy (D) – Explosion

34. (B): Seeds of P, Q and R are dispersed by wind, animal and explosion respectively.

35. (D): Air is a mixture of gases. About 78% is nitrogen, 21% is oxygen and the remaining 1% is argon, carbon dioxide and traces of other gases. Air also contains varying amounts of water vapour, dust particles and smoke.

36. (C): Powdered form of pumice is used by dentist to polish teeth. It is a type of igneous rock (P). Limestone is rich in calcium carbonate and it is used for making cement. It is a type of sedimentary rock (Q). Marble is used to make statues and floorings. It is a type of metamorphic rock (R).

37. (B): The given figure is of Qutub Minar. It is situated in Mehrauli (New Delhi) and has five storeys and 379 steps. Its construction was started by Qutub-ud-din Aibak, continued by Iltutmish and completed by Firoz Shah Tughlaq.

38. (D): In nature, a continuous cycle of evaporation, condensation and precipitation occurs. Water evaporates from water bodies, like lakes, rivers, sea, oceans, etc. Water vapour condense in the air and fall down on Earth as rain, snow, etc. When water falls, it goes back into the water bodies. This continuous process is known as water cycle.

39. (B): During night, land cools down faster than the sea. Warm air above sea rises up and to take its place, cooler air from land rushes towards the sea. This coastal breeze from land to sea is called land breeze.

40. (D): In the given flow chart W, X, Y and Z could be pumice, obsidian, limestone and marble respectively. Red Fort in Delhi is made up of red sandstone. Slate typically breaks into flat thin layers and is used in making cement. Pumice is porous and light weight rock.

41. (A): Marble is formed from limestone. Gneiss is formed from granite. Obsidian is formed due to quick cooling of lava.

42. (D): P is evaporation, Q is condensation, R is rainfall and S is snowfall. Condensation is responsible for the formation of dew on humid cold nights. In condensation, water vapour change into water droplets. Excess of rainfall can sometimes lead to floods.

43. (C): Natural resources can be exhausted. The important natural resources are air, water, land, forests, fossil fuels, solar energy, wind energy, mineral deposits, etc. Coal (fossil fuel) is a natural resource.

44. (C): Water will not enter into the glass as air is present in it.

45. (D)

46. (A)

47. (A): P - A horizon (topsoil), Q - B horizon (subsoil), R - C horizon (bedrock). Plants obtain nutrients from topsoil. Topsoil is the most fertile layer. The roots of plants grow till subsoil.

48. (D): Diesel, petrol, kerosene, wax and lubricants are derived from petroleum.

49. (C): Recycling paper and reusing plastic bottles will help to reduce land pollution.

50. (B): The liquid consisting of hot molten rocks inside a volcano is known as magma. When magma comes out of a volcano and reaches the Earth's surface, it is called lava.

51. (A): Plastic toys and plastic bottles are non-biodegradable hence they cause soil pollution. Fertilisers are chemical substances that when added in large amount degrade the quality of the soil leading to its pollution.
52. (C): The amount of chemical waste present in water collected from different locations are in order $T > S > Q$. No chemical waste was recovered from the water of sites P and R. As per the graph, water of location S contains more amount of chemical waste than water of location Q. So, it can be inferred that factory 2 discharge more chemical waste into the river than factory 1. Water of location T is most polluted, hence it is not suitable for fish culture.
53. (B): Mt. Etna is an active volcano. Earthquake is measured on the Richter scale.
54. (B)
55. (B)
56. (C)
57. (A): Fish will die due to oil spill in the water body.
58. (B): The Sun is located at the centre of the Solar System and Mercury is the closest planet to the Sun. Venus is the second planet from the Sun and Earth is the third planet. Moon is the natural satellite of Earth and revolves around it.
59. (D): On 25th September, the Moon is a Full Moon. Therefore, on 28th September (after 3 days) the Moon will be Waning Gibbous (option D).
60. (C): Temperature on the Moon becomes 127°C during the day because Moon does not have atmosphere. Moon's gravity is $1/6^{\text{th}}$ of that of the Earth.
61. (B): Saturn is the second largest planet in the Solar System. The distinguishing feature of Jupiter is the Great Red Spot on its surface. Venus is the hottest planet in the Solar System.
62. (C): After 14 days, Full Moon will change into New Moon.
63. (D): Uranus is the coldest planet of our solar system. It's Hindi name is *Arun*.
64. (B)
65. (D): Moon has gravity. Uranus is blue in colour due to the presence of methane gas in its atmosphere.
66. (B): In the given figure, P is inner core, Q is outer core, R is mantle and S is crust. Outer core is denser than mantle. Inner core remains in solid state. Mantle is the thickest layer of the Earth.
67. (D): Matter can exist in three different states *i.e.*, solid, liquid and gas. Molecules in a solid state are closely packed (Z), in liquid state they are far apart (X) and in gaseous state they are very far apart (Y).
68. (D): By filtration, insoluble solids can be separated from a liquid by using a filter paper. Therefore, nails can be separated from water by filtration. Soil can be separated by sedimentation and decantation as soil being heavier settles down in a solid-liquid mixture and clear water can be poured out into a separate container. Salt dissolves in water, therefore it can be separated from a salt-water mixture by distillation.
69. (B): Plastic is a bad conductor of both heat and electricity.
70. (B)
71. (C)
72. (C)
73. (A): The substances filled in the four identical syringes are carbon dioxide, oil, stones and wet clay respectively. Carbon dioxide is a gas and gases are highly compressible.
74. (D): Formation of ice, tearing of paper, breaking of glass and melting of butter are physical changes. Burning of wood, burning of paper, cooking of food and rusting of iron are chemical changes.
75. (C): Glass, water and air are transparent materials. Frosted glass and butter paper are translucent materials. Wooden door, mirror, wood, aluminium sheet, iron almirah, tin can and ceramic plate are opaque objects.
76. (B)
77. (A)
78. (D)
79. (C): Bottle opener is a second class lever.
80. (D)
81. (C): Steering of a car is wheel and axle whereas escalator and hospital ramp are inclined planes.
82. (C)
83. (A): Gears move in opposite direction to adjacent gear. Therefore, if gear D is rotating in clockwise direction, then gear G will rotate in anticlockwise direction, gears

F and H will move in clockwise direction and gear E will rotate in anticlockwise direction.

84. (C): Work is said to be done by an object only when the applied force moves the object through a certain distance in the direction of force.

85. (D): Scissor is a first class lever while the other three are second class levers.

86. (C): As time taken by the wax drops to melt is in the order $P > Q > S > R$, therefore, metal tube

should be heated at point X. Heat will be conducted first at position R, then S and Q and then at last to position P.

87. (D): Upon striking out the desired letters we get FREEZING (option A), OILING (option B), BAKING (option C) and DRYING (option D). In drying, moisture is removed from the food item.

88. (D): $\cancel{C} \ N \ \cancel{F} \ Y \ \cancel{H} \ L \ \cancel{M} \ O \ \cancel{X} \ N$
→ NYLON.
Nylon is a man-made fibre.

